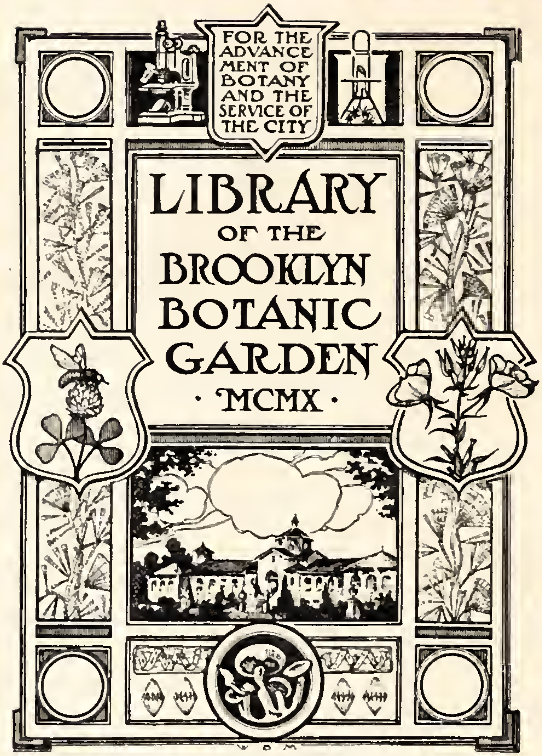

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SCHOOL NUMBER

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., APRIL 7, 1915. NUMBER 1

LIST OF TALKS FOR ELEMENTARY SCHOOL CLASSES

The following list of talks offered to elementary school classes was sent recently to the public and private schools of Brooklyn. As will be seen, the subjects chosen are based on the syllabus in nature study and geography used at present in the public schools. The correlation we have made with these subjects is a rather loose one, purposely so planned in order that through its very elasticity any grade might use any subject with modifications. It has been stated over and over that it is almost impossible to teach Nature Study in city schools because of lack of opportunity for the study of living plants and other material.

The city syllabus calls for the study of wild flowers, and no wild flowers are to be had; common trees are to become familiar friends of the children, and the trees selected are often not in the immediate neighborhood of the school; rice, the food of half the population of the world, must be studied only from books. The existence of a Botanic Garden in Brooklyn now makes it possible, at least once a term, for each school to send its classes to the Garden where they may see growing the various economic and other plants of this and foreign countries.

A member of one of the High School classes visiting the Garden to study economic plants said, "This seeing living things is a whole lot better than reading about them in books." So it is.

TALKS TO BE GIVEN AT THE BOTANIC GARDEN

Grades 3a and 3b

1. Common wild flowers in bloom. (Wild Flower Garden, May-June only.)
2. Common trees. (Field trip, in the Botanic Garden.)
3. Seeds and seedlings. (Experiments.)
4. Methods of propagating plants. (Greenhouse.)
5. Formation of soil. (Demonstrations.)

Grades 4a and 4b

6. Cultivation of plants by slips, seeds, etc. (Greenhouse.)
7. The cultivation of rice in Japan and China. (Lantern slides.)
8. Some useful plants of sub-tropical climates. (Lantern slides and living plants.)

Grades 5a and 5b

9. Plants useful to man. (Lantern slides and living plants.)
10. Trees: blossom and fruit formation. (Botanic Garden grounds, May-June only.)
11. Common shade trees. (Botanic Garden grounds, May-June.)
12. Evergreens and deciduous trees. (Botanic Garden grounds, May-June.)
13. Food plants raised in the United States. (Lantern slides.)
14. Plant industries and products of the United States. (Lantern slides.)
15. Cotton raising in the South. (Lantern slides.)

Grades 6a and 6b

16. Coffee culture in South America. (Lantern slides and living plants.)
17. The rubber industry in South America. (Lantern slides and living plants.)

Grades 7a and 7b

18. Agricultural products of the United States. (Lantern slides.)
19. Some agricultural products of the Orient. (Lantern slides.)

NOTE.—The above talks will be given only at the Brooklyn Botanic Garden, where the greenhouses, economic plants and the grounds make it possible to acquaint the children with the living material. **Principals and teachers should make appointments for classes at least three days in advance.** These talks are listed by grades to correlate with the city syllabus in nature study and geography. Any talk will be given to any class of either public or private schools, regardless of this grading.

TALKS TO BE GIVEN AT SCHOOLS

All Grades

How to make a garden and prepare for the Annual Children's Garden Exhibit, to be held at the Botanic Garden, September 24 and 25, 1915.

At the Garden, demonstrations and experiments on various subjects are taken up in the lecture room and plant houses. All these experiments are simple, easy to do in class-rooms, and planned to be suggestive and to act as a basis for a series of lessons which the teacher may carry on in her own school. It is difficult in the ordinary school-room to teach children the first lessons of plant propagation, a foundation study for their home or school garden work. Such lessons will be given in the children's greenhouse, and each child will have an opportunity to work with his own hands. The economic house, with its fibre plants, its young coffee trees, towering banana plants, and others, offers just the place for classes to see real things in connection with book study. The lantern slide talks are supplemented by a trip through the conservatories.

Field trips for the study of trees, wild flowers, and fruit formation may be taken in the Botanic Garden grounds during May and June. These trips are treated as lesson periods where the children come with note books and acquire their knowledge by direct observation. Similar trips may be arranged for by groups of teachers. Such groups should not consist of less than eight persons. In the local flora section, where the wild flowers of this vicinity are growing, the children may see at one time and place the principal wild flowering plants of the surrounding country.

There may be other talks on botanical subjects and nature study which teachers desire, and which do not appear on the above list. Such talks, so far as possible, will be given on application by the teacher. All applications should be in writing on cards provided by the Garden for this purpose. The cards read as follows:

School......................Grade..........No. of pupils..........
Address.. ....
Date of request...............................

THE ASSISTANT CURATOR OF PUBLIC INSTRUCTION
BROOKLYN BOTANIC GARDEN

I wish to bring my class, as indicated above, to the Botanic Garden on date......................at hour.....................
for purpose checked below:

1. Talk No..........for Elementary School Classes.
2. A special talk on ....
3. Special work in the plant houses.
4. Visit the conservatories under guidance.
5. Visit the out-of-doors collections under guidance.
6. Visit the Japanese Garden.

School telephone..... ....Teacher

(*Additional copies of this card may be had on application*)

In a later Leaflet the preparation for the Second Annual Children's Garden Exhibit will be discussed. Any school may make an appointment with the Assistant Curator of Public Instruction to have this matter presented before its pupils, so that children or schools who wish to compete may conduct their gardens with that end in view.

Ellen Eddy Shaw.

NOTICES

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CHILDREN'S NUMBER

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., APRIL 21, 1915. NUMBER 2

THE SECOND ANNUAL

CHILDREN'S GARDEN EXHIBIT

Date: Again take out your calendar, turn to September and underline the 24th and 25th. Turn to October and underline the 9th. For the 24th and the 25th are the days on which our exhibit, yours and the Brooklyn Botanic Garden's is to be held. October 9th is the day on which the prizes are to be given out. Of course, only prize winners come on this last date; but decide to be a prize winner, if you are a Brooklyn boy or girl.

Classes of Exhibits: Keep this LEAFLET all summer, and refer to it as you need to. First make up your mind just what prizes you are to work for. Anyone may enter three classes of exhibits. If an exhibitor enters an exhibit with his school, then he has remaining two other chances for prizes. The individual entries in a school exhibit will not count for the individual, but for his school. For example, if a boy exhibits marigolds as a part of his school exhibit, so that his school may compete for the bronze statue of Victory, then he must bring a second exhibit of marigolds if he wishes to exhibit these for himself in competition for a medal. But if an exhibit is made under *Class D*—Special Plants—then such a plant will be considered a part of *Class A*. A special plant is any fine individual plant raised and cared for by any boy or girl. The eggplant exhibit last year by a pupil of P. S. No. 129, or the lily belonging to a P. S. No. 66 boy, would be considered special plants.

First look over the following classes and decide which you wish to enter. For upon this decision rests your selection of seeds for your garden:

Class A.—School Display. First prize, a trophy to the school making the best display. Second prize, to be announced.

Class B.—Flowers. First and second prizes will be awarded.

No. 1. Alyssum
Best plant (potted).
No. 2. Asters, Blue
Best collection of ten
No. 3. Asters, Pink
Best collection of ten
No. 4. Asters, White
Best collection of ten
No. 5. Cornflower
Best collection of twelve
No. 6. Dianthus
Best collection of ten
No. 7. Marigold
Best collection of twelve
No. 8. Nasturtium
Best collection of twelve
No. 9. Phlox
Best collection of eight
No. 10. Scabiosa
Best collection of six
No. 11. Sunflower
Largest specimen flower
No. 12. Zinnia
Best collection of ten

Class C.—Vegetables. First and second prizes will be awarded.

No. 1. Beans, Bush
Best pint of beans shelled
No. 2. Beets
Best bunch of six
No. 3. Carrots
Best bunch of five
No. 4. Corn
Best six ears
No. 5. Egg Plant
Best two
No. 6. Kohlrabi
Best four
No. 7. Lettuce
Best two heads (roots and all)
No. 8. Onions
Best four
No. 9. Radish
Best eight
No. 10. Squash
Best one
No. 11. Tomatoes, Green
Best eight
No. 12. Tomatoes, Red
Best six

Class D.—Best Special Plant. First and second prizes will be awarded. This exhibit may also form a part of that entered in Class A.

Class E.—Individual Garden Display. First and second prizes will be awarded for the greatest variety of flowers or of vegetables raised by any one child.

Class F.—Weed Display. First and second prizes will be awarded to the child making the best exhibit of common weeds.

Class G.—Wild Flowers. First and second prizes will be awarded for the best collection of wild flowers, either pressed or in natural condition. Exhibit but one specimen of each variety.

Class H.—Back Yard Garden. First and second prizes will be offered for the best back yard garden.

The exhibit is open to all the boys and girls of Brooklyn. The flowers and vegetables exhibited may be raised here in Brooklyn, or at the contestant's summer home. In the latter case, the exhibit card must be signed by an adult, stating that the exhibit was raised at such and such a place, and was under the direct care of the child himself. When raised at home, the blank may be signed by the principal, teachers, guardian, or parent. Back yard gardens entered under *Class II* will be visited by a representative of the Brooklyn Botanic Garden, and are thus certified to.

Care in making exhibits: All entries in this exhibit are judged very carefully. Most of the points lost by schools and by individuals last year were due to poor arrangement. Suppose you are exhibiting in *Class B*—Flowers, then bring with each flower entry a container, such as a plain glass bottle, like an olive bottle, for the flowers. Choose the best blossoms you have: if six be the number asked for, then bring the six biggest, strongest ones you have raised, and those as nearly perfect in shape and color as possible. If you enter *Class C*—Vegetables, then see that those entered are *cleaned*, that the foliage is cut off, and that the specimens are nearly uniform in size. When you choose your six best tomatoes, have them all near one size, perfect in shape, and evenly colored. Five nice red tomatoes and one half green is a combination which might count against the exhibit.

Again, let us suppose that you have entered one especial plant of corn, egg-plant, or tomato. Such a plant must either be potted or placed in a box of soil. It should be tied to a stake, if necessary, for support. The pot must be clean; the box tidy, and not bursting apart.

Wild flower and weed exhibits must either be pressed and mounted on stiff cardboard, or each specimen must have its container for water. All specimens must be labelled with their common names.

Application Cards: Every single exhibit must have with it the application card with the exhibitor's name thereon. These cards may be obtained in one of the following ways:

1. By sending a self-addressed stamped envelope, with request, to the Botanic Garden.
2. By calling in person at the Botanic Garden office on Washington Avenue.
3. Blanks for all the pupils entering from any one school will, if desired, be delivered to a messenger from that school, calling at the Botanic Garden office.

N. B. Applications may be made only between September 15 and 22.

Admission to the Exhibit: Each exhibitor will receive a button which will admit him to the exhibit at any time during the 24th and 25th of September.

Award of Prizes: The exhibitors to whom prizes are awarded will receive a card saying "Premium" on it. These cards are to be brought to the Botanic Garden on a day specified, and the real prizes will be awarded. The decisions will be made by a committee of judges.

Aid from the Brooklyn Botanic Garden: Any boy or girl desiring some one from the Botanic Garden to visit his back yard garden this summer to inspect it and offer helpful suggestions, should write to the Brooklyn Botanic Garden and make a formal request.

When exhibits must be brought: All exhibits, both those of schools as well as those of individuals, must be brought to the Brooklyn Botanic Garden on the afternoon of September 23rd, or by 10 o'clock on the morning of the 24th. The exhibits will be judged on the afternoon of the 24th, and will then be on exhibition for the public from 3 to to 5 o'clock on the afternoon of the 24th, and from 10 in the morning until 4 in the afternoon of the 25th. After 4 o'clock of this day, exhibitors may remove their exhibits. Prizes will be distributed on Saturday afternoon, October 9th, at 3 o'clock. Silver and bronze medals will be awarded as first and second prizes for individual exhibits. A bronze statue of Victory is the prize for the school making the best exhibit as a whole. This prize is to be competed for annually until one school wins it three times, when it will become the property of that school. A new prize will then be offered. This statue is now in possession of P. S. 152, this school having won it last fall, at the first annual Children's Garden Exhibit.

Ellen Eddy Shaw.

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BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., MAY 5, 1915. NUMBER 3

PLANTS FOR HANGING BASKETS

The practice of growing plants in hanging baskets offers many possibilities for artistic effects which greatly add to the attractiveness of a dwelling. This method of growing plants has the additional advantage of making it possible to grow plants even if there is no space for the garden proper. It seldom happens that a house is so constructed that one cannot, with a little ingenuity, find a place where a basket containing plants can be suspended; therefore, hanging baskets offer special attractions to those who are so unfortunate as to be greatly limited in respect to garden space.

Hanging baskets may be obtained in various styles, sizes, and prices. Those made of wire are most commonly used and are the cheapest, but they possess a disadvantage, on account of the large surface which they expose to the air, of requiring unremitting attention with regard to watering, if the plants in them are to be kept in good condition. Rustic baskets, consisting of a wooden bowl having the outside covered with laurel roots, may be obtained from seventy cents and upwards—the price being dependent upon size. Baskets made of close weave or open-work cane, with metal liners, can be obtained from most florists. These baskets are usually cone-shaped, with chain hangers, and, although they are rather expensive, their artistic appearance compensates for the extra cost. Self-watering "baskets" made of iron are now upon the markets, the cost being $1.25 and upward. These baskets are made with a false bottom, the space underneath being constructed so as to contain water, which is poured in through a tube projecting above the soil level. The water is conducted to the soil in which the plants are growing through sponges, by means of capillary attraction. By using "baskets" of this character, it is not necessary to water the plants so frequently, and the inconvenience of the drip of surplus water, which occurs when the ordinary type of baskets is used, is avoided.

One of the most important factors in the successful cultivation of plants in baskets is that of soil. Owing to the fact that it is usual to grow a number of plants in one basket, in order to furnish it satisfactorily, a rich soil is required to supply their needs. A mixture consisting of one-third well rotted cow manure (or failing this, horse manure) and two-thirds of good garden soil, will suit the majority of plants.

Another important factor is that of light. Of course, there are a number of plants suitable for the purpose under discussion that will grow well in shade, but the majority of flowering plants will only succeed when they are exposed to a considerable amount of sunshine.

Watering must not be neglected. On a hot day, the plants rapidly absorb the limited amount of water that is available in the soil; and in addition to this, the loss by evaporation is considerable, especially in the case of wire baskets, which present such a large surface from which moisture can evaporate.

In preparing the wire hanging baskets for planting, it is first necessary to line the basket with something that will prevent the soil from spilling out. The best material for this purpose is natural sheet moss, which can be obtained from a florist. The moss should be placed with the green side out and the basket partly filled with moist soil, which must be compacted. The plants can now be placed in position in such a way that when the soil is filled in around them it will be somewhat below the rim of the basket. It is better if the surface is made slightly concave, as this facilitates watering. Do not forget, when filling in, to make the soil firm around the roots of the plants. The other types of baskets can be filled in the same way, except that no lining is necessary.

When there are a number of plants to be placed in each basket, the trailing plants should be placed in position first around the rim, then some medium-sized plants of more or less upright growth, finishing up with a tallish plant in the centre. It must not be understood from this that absolute symmetry is advocated; a basket when finished should be somewhat irregular in outline and have every plant displayed to best advantage.

The number of plants to be placed in each basket is dependent upon the taste of the individual, the size of the basket, and the size to which the plants attain. A single plant of Petunia will easily furnish one of the smaller sizes of baskets, and it is possible to use a dozen or more plants of various kinds in the larger sizes without giving them the appearance of being overcrowded.

If, toward the end of the season, the leaves of your plants begin to turn yellow, it is usually an indication that they have exhausted the available food materials. In this case it is advantageous to use one of the complete fertilizers—obtainable from florists in small quantities—according to directions on the package.

If the baskets are required for service in the spring months, early flowering plants of a hardy nature must be planted. The outer rim of the basket could be planted with English Ivy (*Hedera Helix*), or Trailing Myrtle (*Vinca*); these to be used for draping over the edge of the baskets. The filling can be made up of Pansies, Forget-me-not or double English Daisies.

It is, however, during the summer months that the best results can be obtained with hanging baskets. There is a wealth of material from which to choose, and innumerable combinations of plants may be adopted.

A few plants that can be used to good effect are suggested in the following notes. In every case the plants mentioned should not be placed out of doors until all danger of frost is past.

The Boston Fern and its varieties, which are mainly forms of *Nephrolepis exaltata*, make excellent basket plants for shaded, or partially shaded, situations. They must be removed to a conservatory or house before cold weather comes in the fall. A well-grown plant will easily furnish even the large-sized baskets.

"Mother of Thousands" (*Saxifraga sarmentosa*) by itself makes a good plant for shady situations. It has almost round, green leaves, variegated with silvery white, the under sides of the leaves being purple. The plant produces numbers of slender runners, with young plants upon them, after the manner of the strawberry. These runners hang over the side of the basket, completely covering it.

The "Kenilworth Ivy" (*Linaria Cymbalaria*) is another plant that can be used by itself or in combination with other plants. It is a plant having small, ivy-like leaves and purple flowers. This is suitable either for sun or shade, and will stand frost.

An effective combination for a shady position is made up of the trailing Lobelia (*L. speciosa*) around the edge; a few plants of *Begonia Rex*, a variety having beautifully variegated leaves, and for a centre plant a small palm—either *Kentia Balmoreana* or *Phoenix Roebelini*.

For a sunny position the "Floss Flower" (*Ageratum mexicanum*) with its well known blue flowers, a plant or two of "Dusty Miller" (*Centaurea gymnocarpa*), and as a trailing plant "Sweet Alyssum (*Alyssum maritimum*), a small plant of *Dracaena indivisa*, a beautiful foliage plant, with long, narrow, green leaves, in the centre, and filling in the rest of the basket with trailing ivy-leaved geraniums, which should be all of one color.

There are many other plants which can be used for hanging baskets. The following are selected from the many available.

Upright Plants for Sunny Positions

"Cigar Plants" (*Cuphea*), with small, tubular flowers, red in color, with black and white lip.

Lantana. Flowers produced in umbels of various colors.

Swainsonia galegifolia. A very graceful plant producing quantities of pea-shaped blossoms red in color. The variety *alba* with white flowers is most commonly seen.

Pelargonium zonale, the "Geranium" of florists, in various colors.

Trailing Plants for Sunny Positions

Senecio scandens, "German Ivy" is grown for its foliage. Its yellow flowers are seldom produced when grown in baskets.

Thunbergia alata, "Black-eyed Susan." White or yellow flowers with dark colored "eye."

Upright Plants for Shady Positions

Tuberous Begonias of various colors and fibrous rooted Begonias, mainly varieties of *B. semperflorens*.

Torenia Fournieri. Flowers of various colors. The best variety has "velvety" tri-colored flowers of lavender, purple and yellow.

Trailing Plants for Shady Positions

English Ivy (*Hedera Helix*).

Trailing Myrtle (*Vinca*). There are several species and varieties of *Vinca* suitable; most of them having blue flowers.

"Wandering Jew," *Tradescantia*, of which there are several species, either variegated or green.

Space will not admit of giving details of the culture of these plants prior to their being placed in baskets. In most cases, unless one has greenhouse facilities, it is better to obtain grown plants from a florist at planting time.

MONTAGUE FREE.

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LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., MAY 19, 1915. NUMBER 4

THE NATURE OF PLANT DISEASES

Disease in plants, just as in animals, comes from some disturbance of normal, healthy living. Such disturbances may be conveniently grouped into two classes. They may arise, first, from certain more or less obscure atmospheric, soil or cultural conditions which somehow cause sickly, poorly nourished growths, or sometimes abnormal or deranged organs. Such diseases, classed as the non-parasitic, or physiological, diseases, not only occur most abundantly in nature, but they also, by weakening the plant and thus lowering its power of resistance, may even encourage, just as in the case of weakened animals, the starting of parasitic diseases.

The second type of disturbance of the healthy life of plants arises from the attacks of parasitic organisms. Such infectious diseases are very common and their effects are often very conspicuous to the naked eye. Those arising from physiological causes, on the other hand, while sometimes conspicuous enough in their effects, are quite often only obscurely related to a definite cause. The diagnosis of a disease in plants, especially one caused by a bad environment, thus becomes sometimes a matter of extreme difficulty.

We may place into perhaps five categories the parasitic organisms which cause disease in plants: animal parasites, such as nematode worms, and plant lice and other insects; slime molds; bacteria; fungi; and certain parasitic flowering plants. The parasitic diseases to which human beings and animals are subject likewise fall into similar groups, with the exception of the last. Further, just as in the case of the doctors for human beings, it is obvious that the plant doctor must have years of training and experience to be able accurately to diagnose the trouble and to prescribe the proper remedy.

The purpose of this LEAFLET is not to describe many details but only briefly to review a few generalities and underlying principles concerning plant diseases, as well as to indicate some of the lines of work being carried on at the Brooklyn Botanic Garden.

In the first place, as to the nature and distribution of the parasites themselves. The nematode worms mentioned above, or eelworms, as they are often called, are perhaps most harmful in the fields of the South and in greenhouse soils. These parasites are of microscopic size, and they bore into the roots of susceptible plants and cause knot-like, or gall-like growths. Sometimes they even infest leaves. It has proven extremely difficult to eradicate these nematode worms from infested soils, it being necessary in the case of greenhouses, to steam sterilize the soil. In the case of infested fields, it usually suffices to plant for a period of two or three years only those crops which are immune to the parasite, carefully killing at the same time all weeds and susceptible plants. (See U. S. Dept. Agri., Farmers' Bulletin No. 648, on "The control of root-knot"). Space forbids here the consideration of the numberless insect pests parasitic on plants.

The slime molds are low organisms which resemble, in some respects, the protozoa among animals. Two very serious diseases among economic plants are caused by them—the club-root of the cabbage, and the powdery scab of the potato tuber, recently introduced into this country from Canada. (See LEAFLETS, Series II, No. 11). When the soil once becomes inoculated with these parasites, it is almost impossible to rid a field of them except by careful rotation of crops, accompanied by the burning of all infested material.

Bacteria, sometimes popularly called germs, or microbes, are minute plants, sometimes so small that they cannot be seen with the highest powers of the compound microscope. Many plant diseases are caused by bacteria, among the best known of which are crown gall, mosaic disease of the tobacco, black rot of the cabbage, and pear blight. The crown gall organism is of especial interest because of its production in the plant attacked of lesions which resemble closely in some respects those of human cancer. Bacterial diseases variously affect plants. Some cause the cancer-like galls and tumors mentioned above; others cause leaf-spots, wilts, rots and blights. Some undoubtedly affect the plant through poisons, or toxins; others, such as those causing rots, probably affect mainly through digestive enzymes. In plant pathology, the knowledge of such matters as poisoning through toxins or the acquiring for plants of immunity through the production of antitoxins or the use of drugs is still extremely meagre.

By far the greatest number of plant diseases are caused by fungi, well known representatives of which are mushrooms and toadstools, yeasts and molds on bread. Some have quite conspicuous spore-bearing bodies, such as the shelf-fungi, which sometimes form on trees; in others the spore-bearing parts are more or less obscure, as in the rusts of wheat and the chestnut blight fungus. In all of them the fungus threads bore down into the host plant and rob it of nourishment; and the disease is scattered from one plant to another by means of minute spores.

A comparative few of the diseases of plants are caused by seed-bearing parasites. Among those most commonly met with are mistletoe, parasitic on the branches of various kinds of trees in the South and West; dodder, sometimes a serious disease in clover, alfalfa and flax fields; beech-drops, broom-rape and cancer-root.

The plant doctor has been entirely successful in combatting many of these plant diseases; while in the case of others, such as the chestnut blight, he has been unable so far to check the spread of the disease. While much progress has undoubtedly been made in our knowledge as to the life histories of plant diseases and as to how to prevent or cure them, plant pathologists agree that their science is as yet in its infancy, and that the field of unexplored knowledge is vast. We have learned this much, however, that our main methods of attack against most plant diseases should look to prevention. It is true that by providing better sanitation, or by the careful spraying of plants, even after the disease has shown itself, we can sometimes control disease by preventing its spread, yet we must acknowledge that even in these instances prevention is the best cure.

The Plant Quarantine act of 1912, administered by the Federal Horticultural Board of the United States Department of Agriculture, is especially designed to prevent by controlling importations such deplorable accidents as that which permitted the importation of the chestnut blight fungus from China. Besides trying thus to keep dangerous pests out of the country, plant pathologists are also attempting by means of breeding and selection to discover those plants which are resistant to diseases and thus help from another angle to solve the problem of the control of plant diseases. It appears to some, for example, that the only feasible method of attack of the chestnut blight is to find somewhere in the world, perhaps in China, where the disease is thought to have had its origin, chestnut trees which resist the disease to which our native trees apparently so readily succumb. It at least indicates much promise of success along these lines to point out that already, with only a comparatively small amount of work done, we have found plants of the watermelon, cotton, grape vine, flax, asparagus and others, highly resistant against certain diseases to which they are subject. E. W. O.

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During the present season, until further notice, entrance to the Garden may be had only at the laboratory building on Washington Avenue, opposite Montgomery Street, on permission from the office. This temporary regulation is made necessary by extensive grading operations and the construction of new paths throughout the grounds.

The Garden may be reached by Flatbush Avenue trolley to Malbone Street; Franklin Avenue and Lorimer Street trolleys to Washington Avenue; St. John's Place trolley to Sterling Place; Ninth Avenue, Sixteenth Avenue, Union Street, Greenpoint and Smith Street trolleys to Prospect Park Plaza and Union Street, and Brighton Beach elevated to Consumers' Park Station. (The elevated train stops only when the conductor is notified in advance.)

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BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., JUNE 2, 1915. NUMBER 5

A WALK THROUGH THE GARDEN

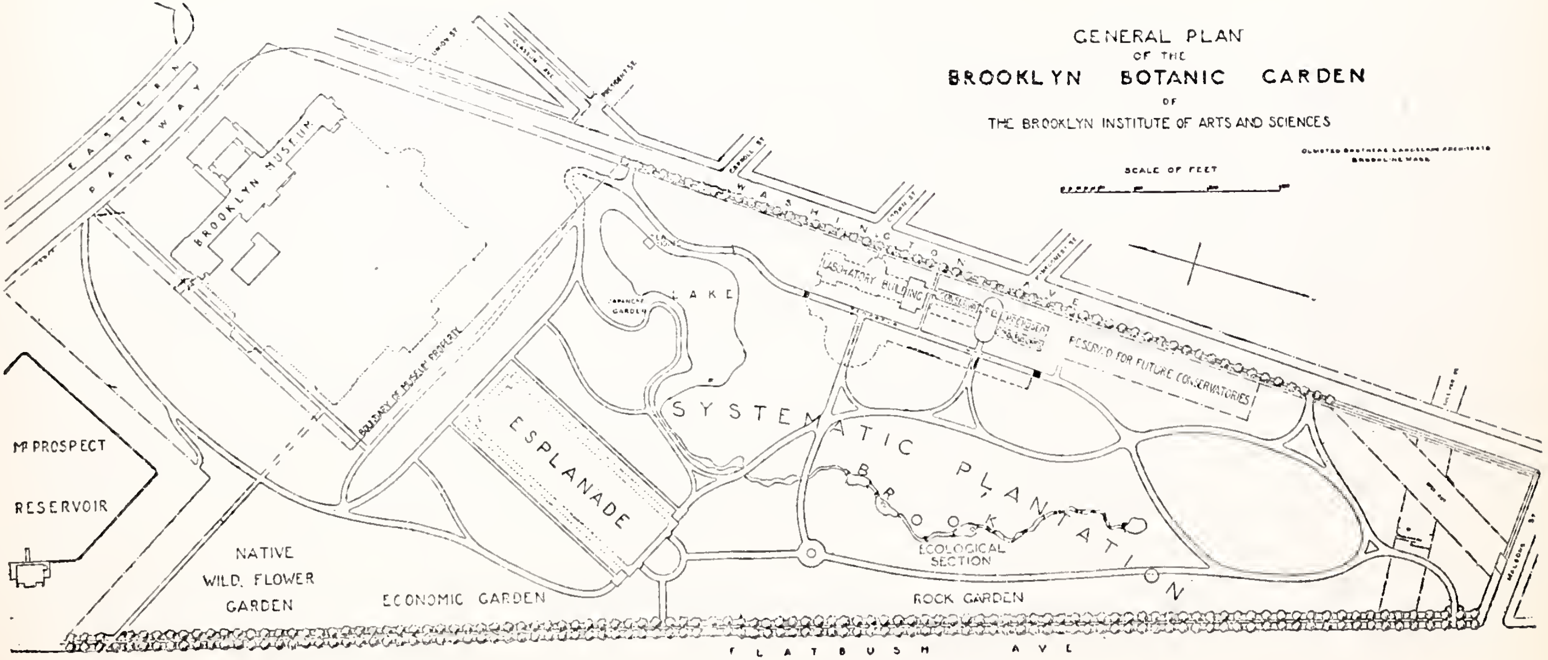
The following LEAFLET describes in a very brief way certain generalities in regard to the various sections and plantations to be met with in a walk around the Garden, if one should start at the laboratory building on Washington Avenue, thence going toward the north, past the Japanese garden; then toward the west; and, finally, southward to the lower end of the Garden.

Visitors going from the laboratory building to the Japanese garden will pass on their right the site of the next four sections of the laboratory building, now occupied by a portion of the children's gardens, and on the left a small hill planted chiefly with evergreens. These comprise part of the coniferous collection which will ultimately occupy nearly all the area surrounding the lake. Over the brow of the hill are spruces and pines. Other pines are on the opposite side of the lake, behind the Japanese garden.

Entering the gate to the Japanese garden at the Tea House, and following the path along the lake shore, two interesting species of evergreen trees will be passed; the first, on the right, a pair of Japanese Umbrella Pines (*Sciadopitys verticillata*). This is a yew-like conifer that gets to be 100 feet tall or more, and is largely planted about temples in Japan. There is a very fine drooping specimen in Shiba Park, Tokio. Just beyond, on the left, and much taller, are specimens of the southern bald cypress, a feathery evergreen from our own southeastern states, and an important source of lumber. In its native habitat, in swampy places, it develops the well-known "knees", and buttress-like projections at the base of the trunk.

In the Japanese garden proper as much emphasis is laid on the rock-work as on the plants, but it is the intention to have most of the plants in the garden of Japanese origin. This may take some years as some of the species are hard to obtain.

Leaving the Japanese garden and continuing along the path around the lake, we pass a small promontory on which are planted evergreens. The central, taller plant is a young specimen of


GENERAL PLAN
OF THE
BROOKLYN BOTANIC GARDEN
OF
THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES
OLMSTED BROTHERS LANDSCAPE ARCHITECTS
BROOKLINE MASS.
SCALE OF FEET
EASTERN PARKWAY
BROOKLYN MUSEUM
BOUNDARY OF MUSEUM PROPERTY
UNION ST
CLASSON AVE
PRESIDENT ST
CARROLL ST
CROWN ST
WASHINGTON AVE
LABORATORY BUILDING
CONSERVATORIES
PROPOSED
RESERVED FOR FUTURE CONSERVATORIES
LAKE
JAPANESE GARDEN
SYSTEMATIC PLANTATION
BROOK
ECOLOGICAL SECTION
ESPLANADE
Mt PROSPECT
RESERVOIR
NATIVE
WILD FLOWER
GARDEN
ECONOMIC GARDEN
ROCK GARDEN
MALBONE ST
FLATBUSH AVE

Cryptomeria japonica, interesting as one of the most decorative of all evergreens when mature. Along the road from Utsunomiya to the great temple at Nikko, Japan, this tree is planted in double rows, for nearly thirty miles. The effect of this great avenue of evergreens leading up to the temple, the trees so close together that they almost touch, is said to be indescribably solemn and impressive.

Leaving the lake and keeping to the right we pass the southern end of the esplanade, which has just been planted with two double rows of the flowering dogwood (*Cornus florida*). The area between these rows of trees was recently plowed, when a crop of rye was turned under, preparatory to a sowing of buckwheat which will follow in a week or two. These operations are all part of a soil improvement scheme planned to build up the fertility of the soil in this section of the garden. Only last autumn this area consisted largely of roads made by trucking thousands of loads of soil and stones in the course of grading operations. This autumn, or at the latest next spring, the permanent lawn to occupy the central space of the esplanade will be put down.

Continuing west towards the Wild Flower garden, the area on the right will be occupied by the Experimental Evolution garden, where it is planned to illustrate among other things, the evolutionary history of some common flowers and vegetables. Across the path, to the west, is the site of the Economic garden, designed to illustrate the sources of food, drug and fiber products of all sorts, that come from plants which are hardy in this climate.

The Wild Flower garden contains about 1,000 different species of plants that are wild within 100 miles of New York. All of the plants in the beds and all those facing the edges of the shrubbery are wild within that radius. There are about 2,600 species that are known, so that the present collection is merely a beginning.

Some of the labels in this section of the Garden are green, indicating that the plant is a true native of this region; others have brown labels, indicating that their native home is elsewhere, but that they are either escapes from gardens or have become established within the 100-mile circle. Many of our common weeds such as dandelion, daisy, plantain, etc., are merely introduced in this region, and form no real part of the native flora.

Among the most interesting features of this wild flower valley are the bog, and a shady path along the top of the border mound where some of our native woodland plants are becoming naturalized. The bog, which is an undrained swamp, contains many interesting bog species, including the cranberry, pitcher-plant, sundew, and many others. Along the shaded path, near the Flatbush Avenue side, will be found many favorite native species, such as trilliums, bloodroot, wild geranium, wild ginger, lady's slipper, rattlesnake plantain, and many others.

At the upper end of the valley a tulip-tree (*Liriodendron tulipifera*) will be found, near the bottom of a slope of rhododendron planting. The tree was planted by Professor Adolf Engler, the noted director of the Royal Botanic Garden, Berlin, on the 13th of October, 1913. Half way up a grass path, leading towards the Museum, is a young tree of sweet gum (*Liquidambar styraciflua*), which was planted by the famous Dutch botanist, Professor Hugo deVries, on the 12th of September, 1912.

Leaving the local flora valley, we pass a clump of the beautiful mountain laurel, which should be in full flower at this time. It is just inside the entrance to the valley. As we walk through the Garden to the south end, we pass, on the left, the long meadow dotted with beds and small trees and shrubs, traversed by the brook which drains the lake and which flows down through its entire length. This meadow contains the general systematic collection of the garden, where the plants are grouped in families. It is designed to bring together here representative species of all the plant families, growing those most nearly related in close proximity to one another. All the shrubs, trees and herbs of one family are planted as close together as the difficulty of such an arrangement will allow. A description of this scheme will appear in a future number of the *Brooklyn Botanic Garden Record.*

To the west of the central meadow, where the boulders are to be seen on the border mound, it is planned to build a rock garden; while in the new lower unimproved portion of the Garden, now being fenced, the systematic collections will be continued and the experimental and children's garden plots will receive much-needed additional space. N. T.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

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E.W.Kittredge

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., JUNE 30, 1915. NUMBER 6

THE ORIGIN AND HISTORY OF SOME OF OUR MORE COMMON GARDEN VEGETABLES

What are and whence came the garden vegetables? I wonder if any of the throng of people one commonly sees at green grocers' stores have ever considered this question as they were inspecting the various goods displayed. Of course, it must have occurred to anyone who gave the subject a moment's thought and who was at all acquainted with the plant world that he had never seen such vegetables growing wild—denizens of the roadside, the forest, the fields, or the prairies. Perhaps, you thought they came from a very far country, where Nature was more bountiful. And, to a great extent, you were right. For, although a large country, the United States can lay claim to being the original home of only a very few of the green grocer's goods.

The vegetables we usually style American are American only in the broad sense, which takes in both American continents. Corn for example is supposed, ancestrally, to have been confined to southern Mexico or to the plateau of central Colombia, though when the white race first came into contact with it, it had been distributed by the Indians and their predecessors over the whole of northern and central South America and all of North America, as far north as southern Canada. Vast fields of this grain were traversed by the Spaniards in their pioneer marches in what are now the states of Alabama and Mississippi. As to varieties, they were as varied in texture as regards their fruits and as kaleidoscopic in color as they are at present. No wizard white man can take credit for "creating" sweet corn, flint corn, pop corn, flour corn and dent corn—for these varieties were all known to the Indian, long before his coming.

Likewise, the original home of the staple and very necessary potato is in the cool elevated region of far-away Peru and the islands of the Chilean Archipelago, where it to-day flourishes in as many varieties, though not in as desirable ones, as there are or ever have been in cultivation. Darwin saw a related species on the sea-shore sands on these Chilean Islands growing to the height of four feet, and other travelers have found red and yellow tubered forms in the ravines in west central Chile and around Valparaiso. A wild form of the same species from which the cultivated varieties came occurs as far north as southern Colorado, but this form has not contributed anything to present day potato-growing, except the "potato-bugs", for which it, along with other Solanaceous plants, long furnished a comfortable and acceptable home. For the tomato and the red pepper, both relatives of the potato and capable of being grafted upon it, we are indebted to the hot regions of north central South America, the former being considered a variety of the small-fruited wild tomato of Peru (*Lycopersicum cerasiforme*), the latter a civilized descendant of *Capsicum annua* of Brazil. Pumpkins and squashes were practically unknown as a vegetable a century and a half ago, except to the agricultural tribes of North American Indians; and in 1830, the American seedsmen listed about ten varieties of our common string bean, the wild ancestor of which is now generally credited to the west coast of South America—most probably Peru and Chile. The lima bean is supposed to have come from the same region.

The favorite food of our southern population and one of the most delicious of our camp-fire delicacies—the sweet potato—is not a native of Africa, as one acquainted with colored people might suppose, but is generally credited to tropical America, though specifically where is still a disputed question, as it has nowhere been found unquestionably wild.

One must not suppose, however, because I have mentioned vegetables of American origin first, that all or even the great bulk of the green grocer's wares are by ancestry American, for such is decidedly not the case. Of forty-four common market vegetables of New York City, thirty-five are European, Asiatic or African in origin, while one, the ordinary mushroom *Agaricus campestris*, is a native of the whole northern hemisphere, although it was first introduced to our tables as an inviting dish by Europeans. Of these thirty-five old world vegetables, all but three or four came from Europe or Asia, so that the majority of our vegetables, as well indeed as our inhabitants, claim these continents as their ancestral cradle. And it is worth noting that most of our vegetables are not from the tropics, where plant life appears to run riot in the form and coloring of its leaves, flowers and fruits.

In a large number of cases, these vegetables have been cultivated by man so long that the finding of their wild ancestors is somewhat in the nature of a guess, especially when we try to discover them through character comparisons. For, many of the variations among cultivated plants are so striking that with our commonly accepted notions regarding variability and heredity, it seems almost impossible that such a plant as the common wild cliff cabbage of Europe and Asia could give rise to all our cultivated forms of cabbage. Yet if it is not the ancestor, what plant is? Of all the plants we know, it most nearly resembles what we believe that ancestor should look like. Growing on the bleak chalk cliffs of Dover or along the Mediterranean highlands, it more nearly resembles our conception of a weed than a valuable vegetable possibility. One wonders what primitive white man could see in this uninviting bitter cliff weed, to cause him to throw about it his special care. But on this we can only speculate, for the eating of cabbage goes back far beyond our historical records and traditions. Among the Greeks, it was held in little esteem, but the Romans were very high in its praise, one of them even waxing poetic. There are said to be no taxonomic varieties of the wild cabbage; but of cultivated varieties—their name is legion. For I cannot call to mind a plant that has varied so in every part of its structure, from the shape of its root to the crown of its flower-stalk. Three hundred or more years ago, a turnip-rooted form was grown in Bavaria and a somewhat similar form is now grown in France. In kohl-rabi, the stem has been modified to form a meaty swelling; in the common boiled dinner, sauer kraut, and salad type of cabbage, the stem spaces between each leaf (the internodes) have been shortened and a head is formed, a character present only to a very limited extent in the wild cabbage, and not present at all in cabbage cultivated in hot climates. In the leaves, variation has given us the red and crinkly Savoy types of cabbage. Cauliflower and broccoli are simply cabbages in which the flowering stalk is much shortened and the development of many closely packed aborted flower buds brought about. In brussels sprouts, a large number of small heads have been substituted for the ordinary one large head. The Georgia collards are headless like the wild cabbage, as is also the kale and the giant cabbage kale of the Channel Islands. The latter produces a large enough stem to use as rafters in cow sheds, a heighth of 8 or 9 feet being not uncommon.

Since in most cases we are not even in possession of authentic records of when these numerous variations occurred, we are not prepared even to guess as to the causes which brought them about. Cabbages were cultivated by the ancient Celts of Scotland and one writer believes that we brought some of the cultivated forms with us from Asia. Cauliflower appears to have been known to the ancient Greeks and according to Pickering, it is recorded first in 540 B. C. A German writer, Hehn, says it is of eastern origin and came to Europe via Venice and Antwerp.

Almost as remarkable variations as in the cabbage, are known in the tribe of lettuces, and although many of you have probably trampled the supposedly ancestral form of this vegetable under foot many times, you probably have never once associated it with the toothsome salad of your dinner course. The common waste land weed, *Lactuca scariola*, is not at first sight a very prepossessing forbear and many a gardener would look in vain for resemblances to tender lettuces. But to the botanist, the mature plants of the wild and cultivated lettuces are very similar, and the differences which the epicurean and the gardener see are only very minor and insignificant distinctions. Especially are these distinctions decreased when one contrasts a well grown plant of the wild lettuce with a somewhat poorly grown Roman lettuce. The wild lettuce is an immigrant to this country, its native home being temperate and southern Europe, northern Africa and temperate Asia. The botanist Boissier mentions a wild variety with crinkled leaves which came from the mountains of western Asia. As to varieties, three are said to have been cultivated 2000 years or so ago by the Greeks, while now we have from 82 to 120 distinct varieties, of which the 42 varieties illustrated are some of the most important.

Another variable vegetable is the pea, of which over five hundred distinct varieties are known, most of which are highly valued as food crops for man. These varieties now come from every temperate region of the world, including the Abyssinian highlands and the desert oases of Turkestan in Western China. They differ from one another in seed color, shape, texture, sugar content, size; in number of peas per pods, in the number of pods per plant, in time of blooming, in time of maturing; in shape, size, texture and color of pod; in shape, size, color and number of flowers; in height of plant; in shape, size, color and texture of the leaves, in number of branches, and in the presence or absence of tendrils. Some varieties have bloomed, ripened their seed and finished their life work before others have reached the flowering stage. Some varieties will mature seed under the most unfavorable conditions, while other varieties will hardly bear seed under any conditions at all. Now from where did such a variable vegetable come? Botanists consider some of the round, smooth-seeded field peas with colored seed coats the ones most nearly like the wild ancestor. But here again, there is a degree of guesswork involved, for many of the so-called wild peas of Europe and Asia may be escapes from the gardens that have come and gone during the last three or four centuries. DeCandolle believes western Asia was probably the original home of the pea, as there is every reason to believe its cultivation in eastern and southern Asia is comparatively recent. The Swiss lake dwellers of the Bronze Age had a small variety of pea said to somewhat resemble the wild field pea of south Europe and this is probably the earliest record of the cultivation of peas we possess. Some authors contend that a true wild pea from which our cultivated pea might have arisen no longer exists, but there is some evidence of this being a hasty statement, as southeastern Europe and western Asia both contain truly wild species of peas which are quite closely related to our garden forms.

When one gets tired of peas for dinner, asparagus is a good

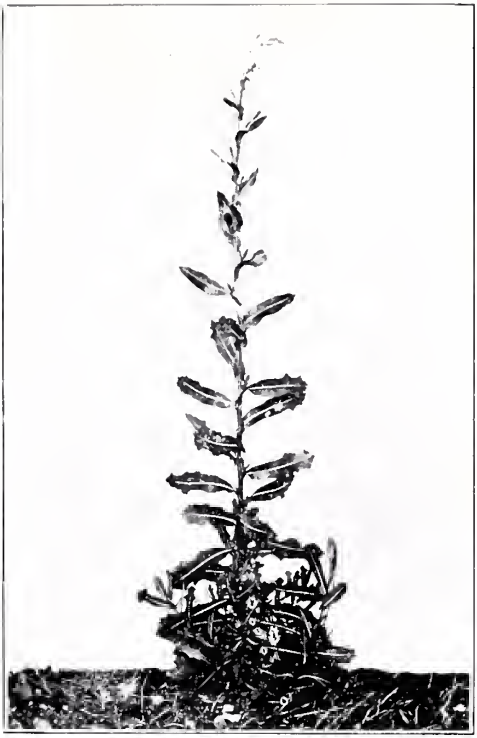


Fig. 1. A nearly mature plant of wild lettuce, *Lactuca scariola* L.

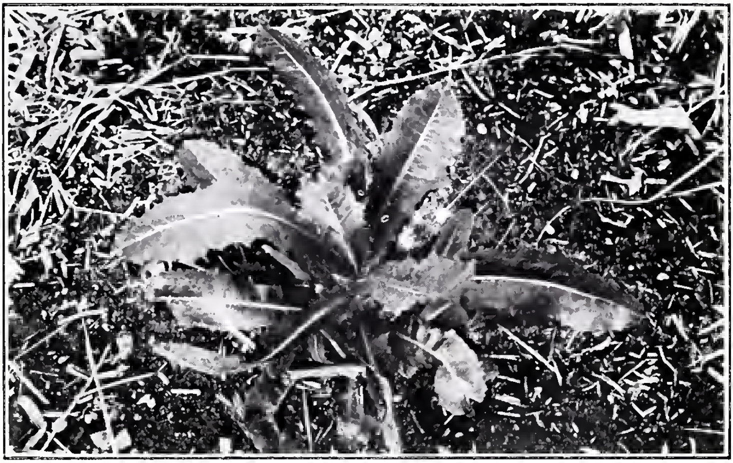


Fig. 2. Wild lettuce in the rosette stage.

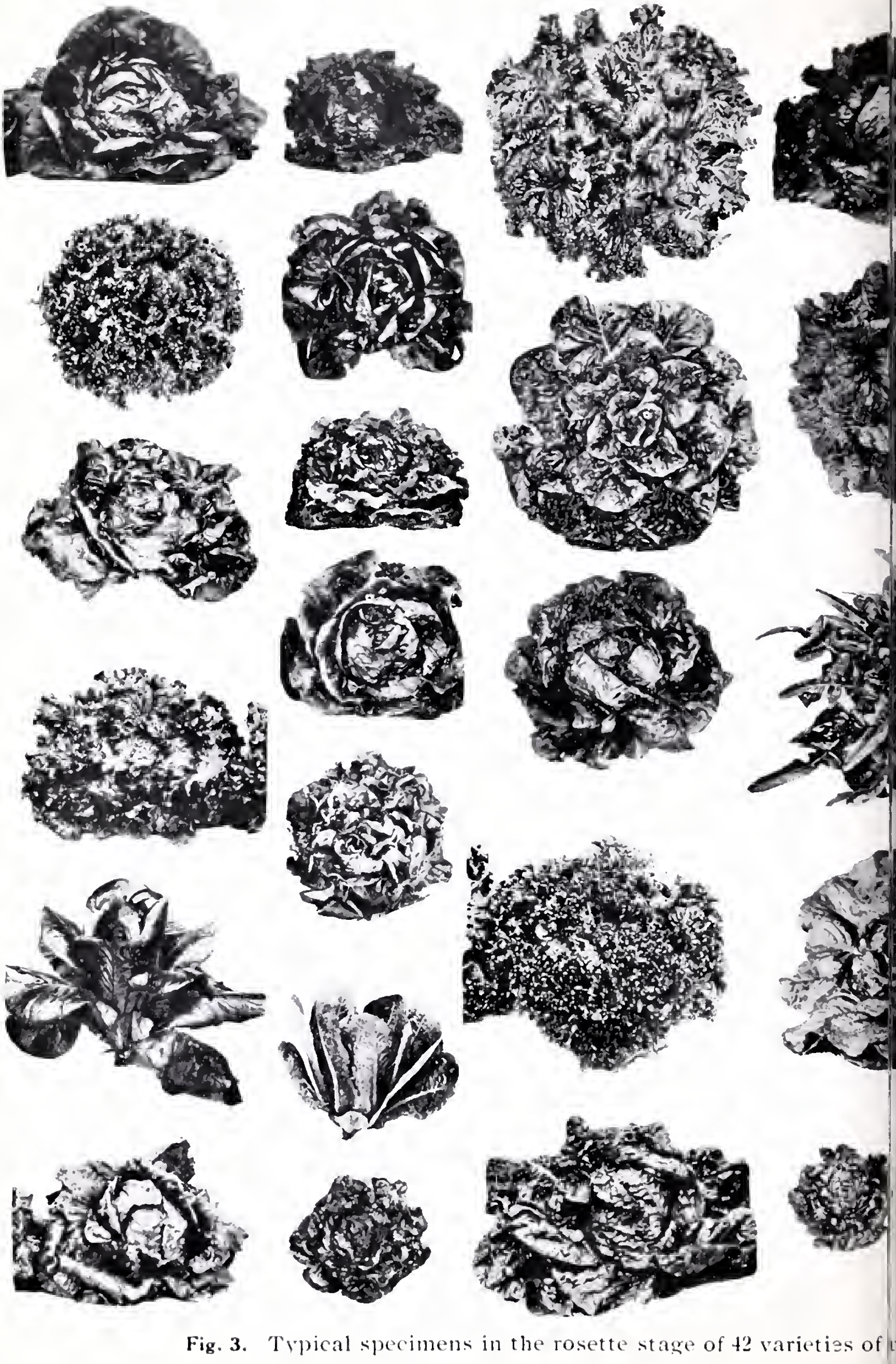
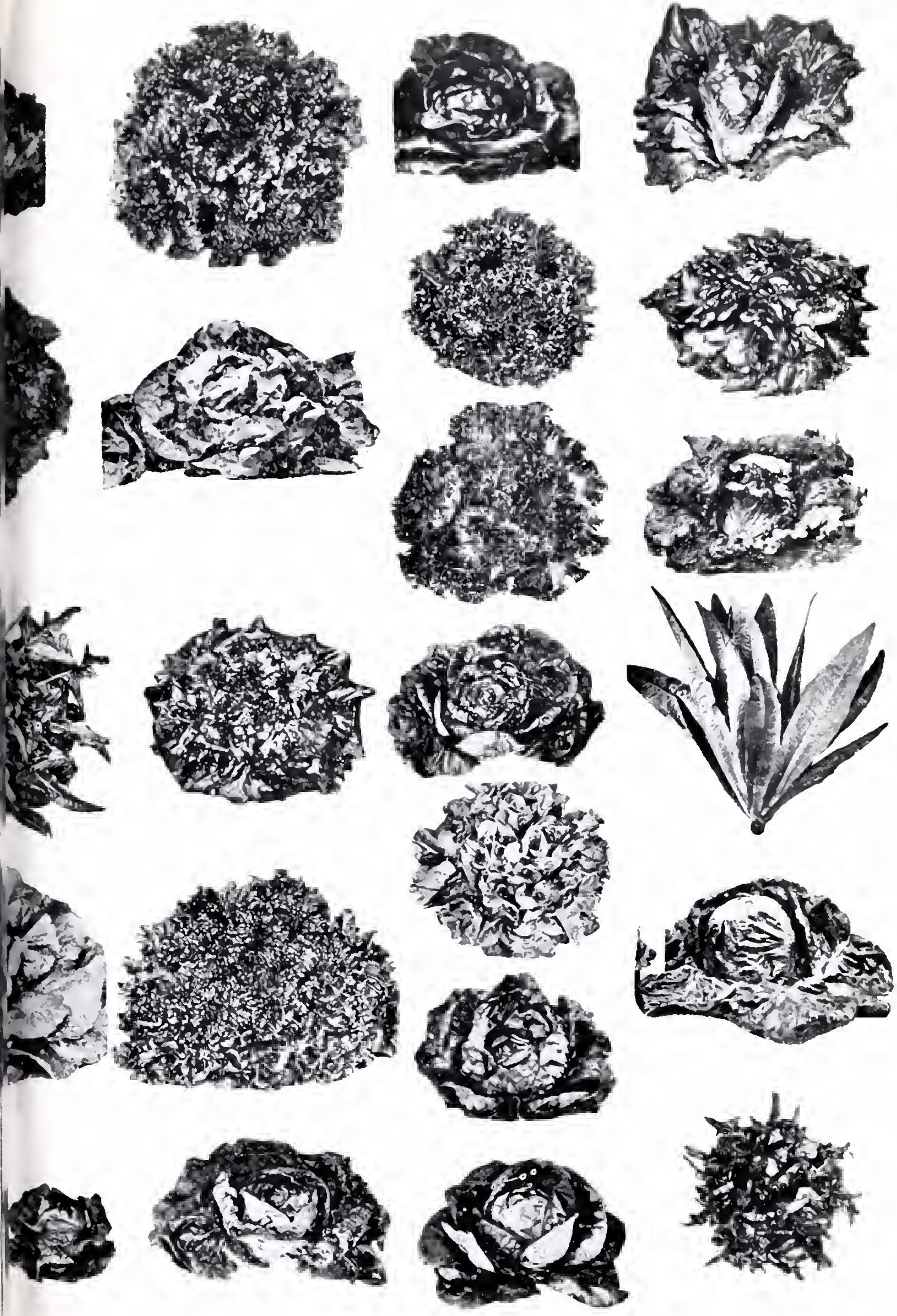


Fig. 3. Typical specimens in the rosette stage of 42 varieties of u



ted lettuce, *Lactuca sativa* L. After U. S. Dept. of Agriculture.

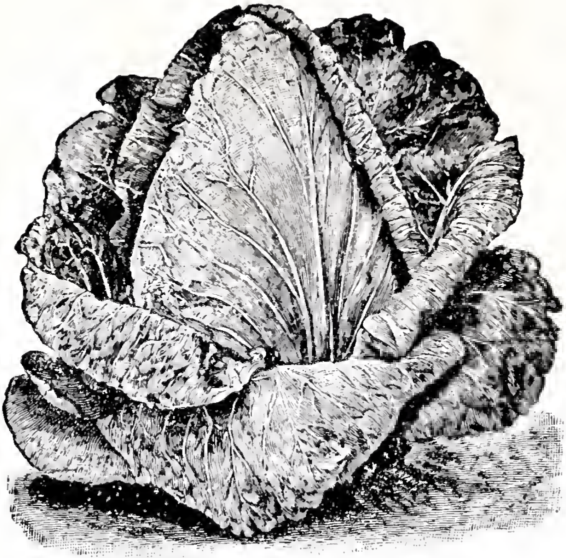


Fig. 4. Typical specimen of one of the modern varieties of cultivated cabbage.

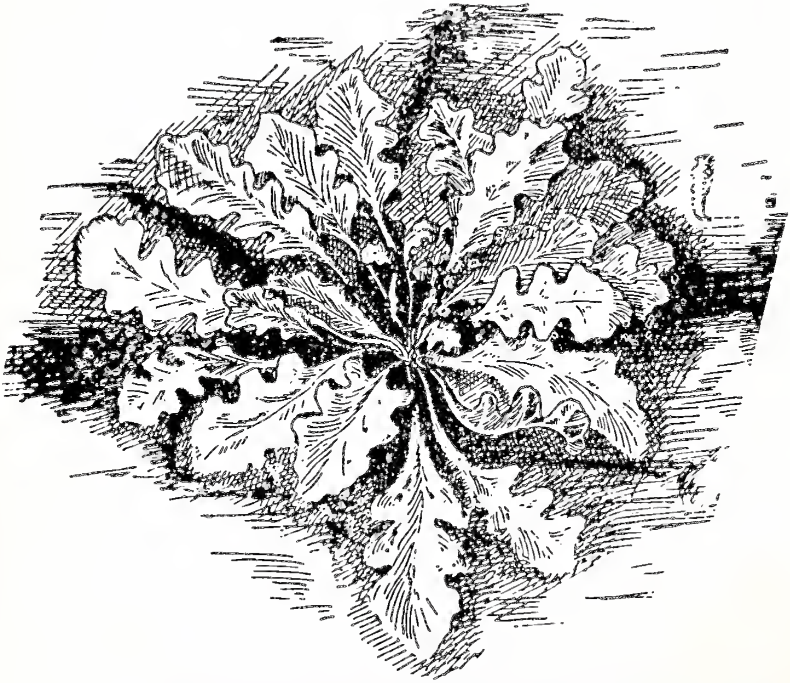


Fig. 5. Sketch of the wild ancestor of the cabbage, as it occurs on the chalk cliffs of Dover, England. After L. H. Bailey.

substitute, if one can afford it. In contrast to the pea, cabbage and lettuce, cultivated asparagus is readily identifiable with its wild ancestor, a plant that to-day covers the waste steppes of south Russia by the billions and furnishes food for browsing herds of horses and cattle. Although grown for over 2000 years as a vegetable, there is very little distinction between the most modern "improved" varieties and those from these wild pasture lands. This lack of variation may be accounted for in part by the method of propagating it, this usually being accomplished by dividing up the old plant, instead of growing it each time from seed.

Often associated in the dinner courses with the heavy vegetables such as asparagus, peas and potatoes, are greens and buttered beets. As for greens, they seem to have been in vogue from time immemorial, and to have consisted of almost anything tender, green and eatable. The chards are beets with slender roots, and thick mid-ribbed leaves, which together with the common red beet and the sugar beet, trace their ancestry back to the common wild beet of Europe and Asia, *Beta vulgaris*. Both the red beet and the sugar beet contain large percentages of sugar. The dandelion is mentioned by Omar Khayyam as "that green herb" and probably originally migrated from Asia. Its use as food is said to be comparatively modern, we having learned to like it from its association with us as a medicinal herb. The chicories are still very wild looking, and show but little effect from their sojourn with man Although widely distributed over the world as a weed, their native country appears to be the continents of Asia and Europe, especially the southern and central portions. The two cresses, the garden and the water, have come to us as vegetables through their association with us as medicinal herbs. The same is true of celery, the ancestor of which abounds as a poisonous water-loving plant in England and other parts of Europe along brooks and drainage ditches. One of the old English herbalists some 400 years ago wrote "This is not woonted to be eaten, neither is it counted good for sauce." The case of the medicinal herb known as rhubarb was different, as it is now a common sauce in America. At one time the leaves of this plant, which differ but little from its wild Volga ancestor, *Rheum Rhaponticum* were used as greens and considered superior for that purpose to spinach and beets.

Turnips, carrots, parsnips and radishes trace their ancestry back to a very weedy, "seedy" lot of forbears, which many of them tend to resemble even now, when growing conditions are not of the best, as is the case with some of my neighbor's radishes. Long, stringy, woody, wiry roots about an eighth of an inch in diameter with very large healthy tops, are what his arduous labor in amateur gardening have brought him. So that upwards of 3000 years of cultivation have not done much for this vegetable. On the Great Pyramid of Egypt, there is said to be an inscription in Egyptian characters, telling how much was expended in radishes, onions and garlic for the workmen. *Daucus carota* is the wild form of the cultivated carrot. It is so variable that several varieties of good carrots may be secured by selecting and cultivating it for a few generations.

Perhaps in an account of this sort, one should not forget to give honorable mention at least to the pungent horse radish and the odorous alliums. The origin of the former is still somewhat of a mystery, unless *Cochlearia macrocarpa* of Hungary is its ancestral parent. Horse-radish was another plant that was first a medicine and then a table friend. Gerard, an old herbalist tells of the antipathy between the horse-radish and the grape-vine. He says "Diuers thinke that this Horse Radish is an enimie to Vines, and that hatred between them is so great that if the rootes heerof be planted neere to the vine it bendeth backward from it as not willing to have fellowship with it." Another ancient herbalist writes that its use as a condiment is all right for strong laboring men, but "it is too strong for tender and gentle stomackes."

The onions or alliums have been long with us, all of them being of very ancient cultivation. In some countries in ancient times they were associated with religious ceremonies, and the Egyptians used them in taking oaths. The Emperor Nero used leeks and oil for his voice. At least seven distinct species, still found wild in the northern hemisphere, have contributed the numerous cultivated forms. *Allium Cepa* is the most important of these, for from it the many ordinary kinds of onions have been derived.

A table of the various vegetables, giving their names, probable date of antiquity of cultivation, and their country of origin, is appended. The letters indicate a certain or probable date of earliest cultivation.

A—a species cultivated for more than 4000 years.
B—a species cultivated for more than 2000 years.
C—a species cultivated for less than 2000 years.
D—a species cultivated very anciently in America.
E—a species cultivated before the discovery of America, without showing signs of a great antiquity of culture.

Name	*Date*	*Origin*
Artichoke	C	Southern Europe, Northern Africa, Canary Islands, Madeira.
Asparagus	B	Europe, western temperate Asia.
Bean (lima)	E	Tropical America, Brazil.
Bean (string)	D (?)	Western South America.
Beet (chard)	B	Canary Islands, Mediterranean region, western temperate Asia.
Beet (root)	B	A result of cultivation (?). Europe.
Brussels sprouts	E	Belgium.
Cabbage	A	Europe, western Asia (?).
Carrot	B	Europe, western temperate Asia.

Name	*Date*	*Origin*
Cauliflower	B	Western Asia.
Celeriac	C	Europe.
Celery	B	Temperate and southern Europe, northern Africa, western Asia.
Chives	C (?)	Temperate and northern Europe, Siberia, Kamchatka, North America (Lake Huron).
Corn	D	Mexico (?), Colombia (?), America.
Cress—garden	B	Persia (?).
Cress—water	B	Europe, northern Asia.
Cucumber	A	India.
Dandelion	C	Europe and Asia.
Egg plant	A	India.
Endive	C	Mediterranean region, Caucasus, Turkestan.
Garlic	B	Desert of the Kirghis in western temperate Asia.
Horse-radish	C	Eastern temperate Europe (Hungary).
Kale		Europe.
Kohl-rabi		Europe.
Leek	B	Mediterrenean region.
Lentil	A	Western temperate Asia, Greee, Italy.
Lettuce	B	Southern Europe, northern Africa, western Asia.
Mushroom	C	Northern hemisphere.
Okra	C	Tropical Africa.
Onion	A	Persia, Afghanistan, Beluchistan, Palestine (?).
Onion (Welsh)	C	Siberia—from the land of the Kirghis to Lake Baikal.
Parsnip	C	Central and southern Europe.
Parsley	C	Southern Europe, Algeria, Lebanon.
Pea (garden)	B	From the south of the Caucasus to Persia (?), northern India (?), Europe (?).
Pepper (red)	E	Brazil (?).
Potato	E	Chile, Peru (?).
Potato (sweet)	D	Tropical America.
Pumpkin	E	Temperate North America.
Radish	B	Temperate Asia. (**Note.**—Mentioned in Chinese book 1100 B. C. Original habitat may be China or Western Asia.)
Rhubarb	C	Europe, Asia, Volga River.
Rutabaga		Europe.
Salsify	C (?)	Southeastern Europe, Algeria.
Spinach	C	Persia (?).
Squash	E	Temperate North America.
Tomato	C	Peru.
Turnip	A	Europe, Western Siberia.
Yams	B (?)	Old World, South Pacific Islands.

ORLAND E. WHITE.

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CHILDREN'S NUMBER

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

Series III Brooklyn, N. Y., September 15, 1915. Number 7

THE CHILDREN'S GARDEN EXHIBIT

A Leaflet was sent out last April telling about the Second Annual Children's Garden Exhibit, to be held at the Brooklyn Botanic Garden the 24th and 25th of this month. After all, the entire field of this exhibit was not covered, because the final results are in the hands of the boys and girls themselves. This second Leaflet, with a heading almost like the first one, is to act as a reminder, to jog the memory and to stir enthusiasm. Many schools, many boys and girls work all through the summer on their gardens and at the end of the season feel their results are not sufficiently fine to warrant entry in the exhibit. Do not feel this way; it is far better to finish the race and to measure your results against the results of others. Last season one school brought in an exhibit which in no way measured up formally with those of the other schools. The principal of this school said, "I wish my children to stand now with the others. The point is for them to see where they stand and then build upon this knowledge gained."

Please remind the children of your school about this exhibit. First, application cards must be had for each individual child entering an exhibit. These cards may be obtained between the dates September 15 and 22. The very easiest way to handle this matter is for the school itself to send for all the cards needed. Any individual child may also send directly to the Brooklyn Botanic Garden an addressed and stamped envelope for his own card if he wishes to do so. A button marked "Exhibitor" goes back with each application so every one exhibiting is known by his button when he comes to see the exhibition at the Botanic Garden. An entry card must be attached to each exhibit: that is if you are exhibiting ten blue asters in Class B, No. 2, you must have the card securely tied to the bunch of asters. If one child makes three entries, he must use three cards. Each exhibit must be labeled. No individual exhibit can be a part of the school exhibit except in the case of Class D, Special Plants. Perhaps this needs some further explanation. The annual flowers and vegetables raised in your gardens are not special plants; you have many of these. If you exhibit anything in Class B and C and wish this to help out your school exhibit as well as to stand for individual prizes, then double amounts must be brought; two bouquets of blue asters for example. But suppose you wish to exhibit a fine begonia you have been raising, then such a plant is a special; you do not have quantities of these plants; so you make out two cards and mark one for Class A, the other for Class D and attach both cards to this plant. Then this plant stays with the school exhibit and also it is competing for an individual medal as well.

Read over all these classes again to be sure you know how to fill out your cards.

Class A.—SCHOOL DISPLAY. First prize, a trophy to the school making the best display. Second prize, to be announced.

Class B.—FLOWERS. First and second prizes will be awarded.

No. 1. Alyssum
    Best plant (potted)
No. 2. Asters, Blue
    Best collection of ten
No. 3. Asters, Pink
    Best collection of ten
No. 4. Asters, White
    Best collection of ten
No. 5. Cornflower
    Best collection of twelve
No. 6. Dianthus
    Best collection of ten
No. 7. Marigold
    Best collection of twelve
No. 8. Nasturtium
    Best collection of twelve
No. 9. Phlox
    Best collection of eight
No. 10. Scabiosa
    Best collection of six
No. 11. Sunflower
    Largest specimen flower
No. 12. Zinnia
    Best collection of ten

Class C.—VEGETABLES. First and second prizes will be awarded.

No. 1. Beans, Bush
    Best pint of beans shelled
No. 2. Beets
    Best bunch of six
No. 3. Carrots
    Best bunch of five
No. 4. Corn
    Best six ears
No. 5. Egg Plant
    Best two
No. 6. Kohlrabi
    Best four
No. 7. Lettuce
    Best two heads (roots and all)
No. 8. Onions
    Best four
No. 9. Radish
    Best eight
No. 10. Squash
    Best one
No. 11. Tomatoes, Green
    Best eight
No. 12. Tomatoes, Red
    Best six

Class D.—BEST SPECIAL PLANT. First and second prizes will be awarded. This exhibit may also form a part of that entered in Class A.

Class E.—INDIVIDUAL GARDEN DISPLAY. First and second prizes will be awarded for the greatest variety of flowers or of vegetables raised by any one child.

Class F.—WEED DISPLAY. First and second prizes will be awarded to the child making the best exhibit of common weeds.

Class G.—WILD FLOWERS. First and second prizes will be awarded for the best collection of wild flowers, either pressed or in natural condition. Exhibit but one specimen of each variety.

Class H.—BACK YARD GARDEN. First and second prizes will be offered for the best back yard garden.

After all the cards are made out and the exhibits brought to the school, if so desired by the teacher, they must all be brought to the Brooklyn Botanic Garden, either Thursday afternoon, September 23, or Friday morning, September 24, by ten o'clock. But first be sure the exhibit is in good shape. All the plants should be staked up properly, the pots cleaned, vegetables scrubbed; and with each bunch of flowers bring a plain glass bottle, like an olive bottle, for a container.

How is a school to bring one hundred or more individual exhibits to the place of exhibition? It can be done. P. S. 152, first prize winner of last year brought its exhibit in an automobile offered for the purpose by the father of an exhibitor. P. S. 129, second prize winner, chartered a trolley; one hundred children came on that trolley with their exhibits, while over the road two boys came from the same school pushing a cart filled with plants which were too large to be carried on the trolley. P. S. 66 hired a trucking team and sent delegates with its exhibit. So it is possible to bring your exhibit to the Botanic Garden.

The exhibit is put in place late Friday morning; while in the early afternoon it is judged. Then premium cards are placed on the prize winning exhibits and the public is invited to come from 3 to 5, Friday afternoon, September 24, and from 10 to 4 on Saturday. After 4 on Saturday any exhibitor may remove his exhibit.

Schools and exhibitors must take away those plants they desire to save. Exhibits will be held until Wednesday of the following week. They must be removed by this time.

The prize winners will receive their premium cards by mail. On the 9th of October, at 3 p. m., they must appear with these cards to receive their prizes. Prize winning schools should send to receive their prizes a representative, preferably a student from the graduating class. At the present time P. S. 152 holds the trophy, a bronze statue of Victory. This is returned to us before the exhibit and will be awarded to the school having the best general exhibit. Any school receiving this trophy three times keeps it. Then a new trophy will be entered for competition.

Will you help to make the second annual Children's Garden Exhibit a success ?

Enter your exhibits, come to the exhibit, bring your friends.

ELLEN EDDY SHAW.

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BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., SEPTEMBER 22, 1915. NUMBER 8

EXHIBIT OF FERNS

A collection of fifty-five named varieties of the Boston fern may be viewed at the plant houses of the Garden on October 8-10, 1915.

THE BOSTON FERN

AND SOME OF ITS VARIETIES

The rubber plant is no more the most favored house plant even in Brooklyn. Florists who formerly raised and sold scores of thousands of rubber plants in a year now raise them only in the hundreds or a few thousands. Instead of the "elastic fig" the florists now raise the Boston Fern or some of its varieties in great numbers, some establishments producing over one hundred thousand plants of these ferns each year.

The Boston fern appeared originally as a variety of the sword fern, *Nephrolepis exaltata*, a species common in all tropical countries and growing wild in our own country in Florida. The sword fern is essentially like the familiar Boston fern, but is stiffer, with narrower leaves, and less easy to grow. In both the sword and Boston ferns the leaf consists of the central strand or midrib with numerous side leaflets or pinnae. Such a leaf is spoken of as "once-divided" or "once-pinnate". When the pinnae or leaflets are themselves divided into smaller leaflets, as in many ferns and other plants, the leaf is called "twice-divided" or "twice-pinnate". Leaves may also be three, four, or even more times divided.

The Boston fern received its name because it was first discovered in a lot of sword ferns being grown by F. C. Becker, a florist of a suburb of Boston. As a matter of fact it might well have been called the "Philadelphia" fern, as it was one of two hundred plants bought from Robert Craig, a Philadelphia florist, who, however, had not noticed that he had anything different from the ordinary sword fern. The Boston fern was introduced about 1895 and florists everywhere began to grow it in considerable numbers.

About eight years later, F. R. Pierson, of Tarrytown, found among his ordinary Boston ferns a plant with twice-divided leaves. This was so considerable a departure from the regular Boston fern type that he began to propagate it in large numbers, and later introduced it as a new variety, which he called *Nephrolepis Piersoni*, or Tarrytown fern. From this form he has since developed many other and better varieties, some three and four divided. About the same time John Scott, a Brooklyn florist, discovered among his Boston ferns a new variety which was like the Boston fern except that it was much smaller, and so could be grown in smaller pots, and would not require as much space. He did not, however, call it the Brooklyn fern, but gave it his own name and called it *Nephrolepis Scotti*. It has since become one of the most widely grown of all Boston fern varieties.

Since then other florists have discovered and introduced many other new varieties of Boston fern until now there are at least forty different named forms. Some of these are very beautiful, like *Whitmani* and *magnifica*, introduced by Barrows of Whitman, Mass.; *Harrisi*, by Harris of Philadelphia; *Roosevelti* and *Teddy Jr.*, by the American Rose and Plant Co., of Springfield, Ohio; *robusta*, by Craig of Philadelphia; *Smithi*, by Dreer of Philadelphia, and others. So many different kinds have been produced that it has become advisable to study them carefully, and for this reason a collection is being gathered at the Brooklyn Botanic Garden. Here the plants are being grown and studied. Nearly all of the named American varieties have been already obtained, as far as possible, from their original producers in order that there might be no doubt about the authenticity of the varieties.

Some one will wish to know about the selection of the proper varieties for house culture. This will depend entirely on the conditions which obtain. With a conservatory and proper care it will be possible to grow any of the varieties. Good light they all need. The brightest sunlight is better than too little. In the florists' greenhouses they are usually grown in the brightest light, or in summer with a coating of whitewash on the glass roofs. A moderate temperature, in winter from fifty to seventy degrees Fahrenheit, is maintained for them in the commercial establishments. Of water they need enough to keep the soil moist, not wet. They should not be allowed to become dried out, nor should they be kept continuously soaked.

In the ordinary city house or apartment with hot air, water, or steam heat, gas illumination, and few and narrow windows, the successful cultivation of any kind of plant is likely to be next to impossible. The fumes of burning gas as well as escaping gas itself are very poisonous to plants. The effect of the ordinary methods of heating city houses is to produce very dry air which most plants do not like. Ordinary windows give too little and too one-sided illumination, and, it may be noted, the careful arrangement of window curtains is not likely to be conducive to good plant development, nor should plants be placed in a room with particular regard only to their relation to the furniture.

It is possible, however, to grow Boston ferns in houses with good illumination, especially if there is a yard where the plants can be placed for the summer to recuperate and obtain a fresh start.

Even under the worst conditions in city apartments, it is possible to use ferns and other plants for decoration if one is willing to consider them, not as permanent members of the household, but rather as temporary visitors, something in the nature of flowers which are discarded as soon as their beauty is gone. But flowers fade in a few days while a fresh fern plant will last at least a month in good condition, if kept moist, and may easily keep looking well two or three times as long. Good sized plants in six inch pots can be purchased for from seventy-five cents to a dollar, with larger plants proportionately more As a further reason for occasionally renewing the house fern it may be noted that not even the florist can grow an old plant so that it looks as well as a young plant. This is due to the methods by which new Boston fern plants are reproduced and to the fact that the young leaves of these ferns, up to a year or so old, are better looking than the leaves produced by older plants.

The Boston fern and its varieties reproduce by runners or suckers, slender shoots which spread from near the bases of the leaves, either under ground or above it, and take root occasionally, forming buds and new leaves. These young plants are separated from the parent plant and are set out to grow bigger. With good conditions each will grow rapidly and finally develop, in less than a year, into a good sized plant with numerous fresh green leaves, arranged in a symmetrical cluster. This, the plant's most beautiful period, lasts for several months. Later leaves appear with brown spots on the back, the little clusters of spore-cases. These leaves are hardly as beautiful, or are plants at this stage as valuable commercially, as in the younger period. I do not of course mean that a fern ceases to be an object of beauty when the spore-cases appear, but its pristine freshness has been lost, and in purchasing ferns it is well to remember that such old leaves indicate old stock, which the florist was not able to dispose of at its best stage.

Finally some may wish to know something about the selection among the various forms of the best kinds for different purposes. For house cultivation from year to year the following varieties of the Boston fern—*Harrisi*, *Roosevelti*, *Scotti*, and *Teddy Jr.*,—in the order named, will probably succeed best of all. These are all once-pinnate forms, the last two named being dwarfs. Among the twice-pinnate forms, the best for house purposes are the Pierson forms, *elegantissima* and *elegantissima compacta*, and the Barrows varieties, *Whitmani* and *Whitmani compacta*. *Scholzeli* and *magnifica* are dainty, three-pinnate forms, while *Smithi*, the so-called Philadelphia lace fern, and *Amerpohli* are exquisite four-pinnate forms, which even in the best house conditions need to be replaced occasionally with fresh stock from the florist.

In conclusion it may be noted that despite the difficulties in the way of cultivating ferns in the house the Boston fern and its varieties have won their place as the most popular house plant because there are no other plants of equal beauty which will succeed as easily.

RALPH C. BENEDICT

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TEACHERS' NUMBER

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., OCTOBER 6, 1915. NUMBER 9

TALKS FOR ELEMENTARY SCHOOL CLASSES

A list of talks open to elementary school classes was printed by The Brooklyn Botanic Garden last April. These talks were planned to correlate with the subject matter in the city syllabus for nature study and geography. Many public school classes came to the Garden during the spring; some came in small groups with teachers for a demonstration lesson or one in the greenhouse; others came in larger groups for lantern slide talks and trips through the greenhouses. Usually about one hundred children comprised the larger groups. Such a group represented an entire class, that is the A and B sections of one grade.

We are handicapped at present at the Garden by the small size of our lecture room in which only about fifty children can be comfortable during a lantern slide talk. So when one hundred boys and girls come, fifty attend the lecture, while the other fifty in two groups of twenty-five each with an instructor in charge go through the greenhouses. The economic house is filled with those plants which we read of in the geography and usually only see in pictures. Here is the big banana plant, little coffee trees, the tea plant, rubber plants, bamboo, and even bull-rushes under which one small boy looked for Moses himself. This house might mean much more to the classes than it ever has. It would be advisable, for example, for the children to bring their note books and pencils and make a real business of this little journey through the sub-tropics.

The following list of talks is our second list. We have again graded the subjects, but any of these talks will be given to any grade upon request. The listing is made to show the correlation with the present syllabus, as mentioned before.

TALKS TO BE GIVEN AT THE BOTANIC GARDEN

OCTOBER 20 TO DECEMBER 15

GRADES 4A AND 4B

1. Cultivation of plants by seeds, slips, runners, etc. (Greenhouse.)
2. What plants need for growth. (Experiments.)
3. Plant variations in the hot, cold and temperate countries. (Lantern slides and specimen plants.)
4. The cultivation of rice in China and Japan. (Lantern slides.)
5. How boys and girls can help make Brooklyn a more beautiful city. (Lantern slides.)

GRADES 5A AND 5B

6. How to plant bulbs for winter bloom. (Demonstration.)
7. Plant foods raised in the United States. (Lantern slides.)
8. How nature disperses her seed. (Demonstration.)
9. Useful plant products. (Lantern slides.)
10. How to distinguish common evergreens. (Study of the trees themselves.)

GRADES 6A AND 6B

11. The classroom window box. (Demonstration.)
12. Coffee culture in South America. (Lantern slides.)
13. How rubber is obtained. (Lantern slides.)

GRADES 7A AND 7B

14. Plants for classrooms and care of same. (Demonstration.)
15. Agricultural products of the United States. (Lantern slides.)
16. What plants mean to the world's commerce. (Lantern slides.)
17. The life story of a tree. (Demonstration and slides.)

NOTE.—It is suggested that when such talks as 1, 6, 10 and 11 are desired that the groups be made so that the individual child may assist in the lesson. If no more than fifty children are in the section, this may be divided into two small groups, and each child will be able to work and take away with him to his classroom and home the intimate knowledge thus gained. The above talks will be given only at the Brooklyn Botanic Garden, where the greenhouses, economic plants and the grounds make it possible to acquaint the children with the living material. **Principals and teachers should make appointments for classes at least three days in advance.** These talks are listed by grades to correlate with the city syllabus in nature study and geography. Any talk will be given to any class of either public or private schools, regardless of this grading.

There may be other talks on botanical subjects and nature study which teachers desire, and which do not appear on the above list. Such talks, as far as possible, will be given on application by the teacher. All applications should be in writing on cards provided by the Garden for this purpose. These cards read as follows:

School .... Grade ....No. of pupils..........

Address ....

Date of request...... ....

THE ASSISTANT CURATOR OF PUBLIC INSTRUCTION

BROOKLYN BOTANIC GARDEN

I wish to bring my class, as indicated above, to the Botanic

Garden on date, ... at hour.......................

for purposes checked below:

1. Talk No.......... for Elementary School Classes.
2. A special talk on.................................
3. Special work in the plant houses.
4. Visit the conservatories under guidance.
5. Visit the out-of-doors collections under guidance.
6. Visit the Japanese Garden.

School telephone............ ....Teacher

(*Additional copies of this card may be had on application*)

ELLEN EDDY SHAW.

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BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III Brooklyn, N. Y., October 13, 1915. Nos. 10 and 11

THE CROSSING OF FLOWERS

> "Flower in the crannied wall,
> I pluck you out of the crannies,
> I hold you here, root and all, in my hand,
> Little flower—but *if* I could understand
> What you are, root and all, and all in all,
> I should know what God and man is."

The desire to create something unique, new, beautiful or wonderful out of something commonplace is an innate ambition of most people, though most of us are so engrossed in the fight for food and shelter that we rarely have the opportunity to realize such an ambition.

Plant breeding is a field in which this ambition may be to some extent satisfied, without a great outlay of time or money. Moreover, it is a field in which the results of one's efforts will be much appreciated, for the discoverer or creator of a new rose, a new dahlia or a new apple is giving just as much pleasure and doing just as much good as are writers of books or explorers of new countries.

It does not take a Burbank nor a Lemoine to produce new flowers, fruits, and vegetables, but it does take patience, love of plants, a little knowledge of their life histories, and a small garden or greenhouse. Once in possession of these, almost anyone is in a position to become a breeder or discoverer of new fruits and flowers. Burbank, Lemoine, Bull, Laxton, Eckford, the orchid hybridists, and many others famous for what they have done along these lines, had nothing more at the start. To be the originator of the Concord grape—the blue grape so common on our market at this time of the year—is surely as worth while as to have been the discoverer of the North or South "Poles" or the painter of "The Horse Fair". To have been instrumental in making our gardens and parks rich in varieties of lilac, gladioli and sweet peas, and giving happiness and inspiration to millions of people is certainly an achievement as valuable to humanity as the work of Edisons and Alexander Graham Bells. In such work, in addition to the satisfaction that comes from the good that one is doing, there is the joy of independent accomplishment, the feeling of having actually created out of commonplace materials something absolutely new and unique, such as an American Beauty rose, or a picotee sweet pea, for in all wild Nature you would hunt in vain for such flowers.

But more even than these, the amateur gardener and plant breeder has the pleasure of actually watching the laws of nature at work creating a new form from an old one, a process by which our old earth has covered itself with the myriads of kinds of plants that abound in every forest and field about us.

In order intelligently to bring into being these new forms of plant life, it is first necessary to know something about the parts of a flower and the method by which a seed is produced. Flowers in the ordinary sense are bright-colored, showy things that give color to a garden or look pretty on a woman's dress. Flowers in a scientific sense are the seed manufactories of a great group of plants, comprising more than 125,000 kinds or species. Some, such as those of wheat, beets, blue-grass and willow, are very inconspicuous and barely noticeable. Others, such as orchids, cannas, sunflowers, and dandelions, are very showy and often strikingly beautiful.

Flowers, then, are the preliminary arrangements to the birth of new plants, the precursors of seeds; in reality, as I said before, the plants' seed manufactories. For convenience, examine a flower, such as the Easter-lily, and you will find it to consist of at least three general parts, put together on the plan of three circles, one within the other. The first circle (the showy white portion) is composed of petals and sepals, three of each; the next circle, of stamens, or male organs, six in number; and the third or innermost circle, of pistils or female organs, three in number, but united with each other so as to resemble one. The outer whorls are generally regarded as a protection to the two inner circles, though, in cases where they are bright-colored, they may serve also in attracting butterflies, moths and beetles, which help in bringing about cross-pollination. In flowers, such as peas and tobacco, this outer circle or protective envelope consists of one green circle and one bright-colored circle. The stamens are each made up of a stem with one or two little bags full of a mealy dust called pollen. The pistil is usually a flask-shaped receptacle, sticky at the upper end, and full of little sack-like bodies at its larger or basal end. These little sack-like bodies or "baby seeds" as you might call them, later develop into real seeds, but only after a great many things have happened.

Let us follow up the beginning of a seed and see just what these preliminaries to becoming a real seed are. First a tiny speck of pollen dust is brought by wind, insect or other agency to the sticky surface of the pistil. Nurtured by the sweet sugary substance there, it starts to grow by sending out a long colorless tube. The tube grows down through the long stem-like pistil until it reaches the region of the little sack-like bodies, whereupon it is attracted to the opening of one of them and enters, discharging two tiny colorless male bodies called *sperms*. One of these little snake-like sperms unites with the egg, and the resulting mixture of egg and sperm grows into the first stage of the new plant or embryo, as it is usually termed. The other sperm unites with two other tiny bits of jelly-like substance, somewhat similar to the egg, and gives rise to the greater part of the starchy substance of the seeds—the food that keeps the tiny plant alive until it gets its roots in the soil and makes its own food. The walls of each sack eventually become the walls of the seed, or the seed coat. Both the embryo and the starchy mass of food cells grow and produce more and more cells until the seed finally attains maturity, or, as we say, "gets ripe", a stage in a plantlet's life history somewhat comparable to the stage in our own lives when we are ready to be born.

Now suppose you wished to cross a white Easter-lily with a red lily, how would you proceed? That depends altogether on whether you are working for scientific as well as for practical results or for practical results alone. The former method is the one by which we have secured most of our knowledge of the laws of heredity, while the latter is the method common for two hundred years or more to those working for practical results. The first is the more careful method of those greatest of all hydridizers, Mendel and DeVries. The latter is the method of the host of practical breeders. By the method of Mendel one is able to secure the same results twice, because every step is carefully recorded; by the method of the practical men, knowledge of the material and of the method by which they secured their results is largely guesswork.

In plant-breeding work of a scientific nature, extreme care should be taken in selecting the kinds of plants on which to work out a problem. Some plants, such as peas, mature three generations a year; others, such as most of our fruit trees, give us a generation that matures fruit in two to twelve years. Some plants have large flowers, which bear rough handling and mutilation without much resentment; other plants bear small or delicate flowers. Small flowers, as in sugar beets, wheat, alfalfa, mignonette, are hard to see enough of to work with, while delicate flowers, such as are characteristic of touch-me-nots, melons and many greenhouse plants, will not tolerate much mutilation and are prone to fall off unless handled with extreme care. Some plants, as corn for example, are so bountiful with their pollen dust that it is extremely hard to keep the female flowers or "silks" protected from it, even by the most careful manipulation of paper bags and sterilizing apparatus. Carnations and many double flowering plants, on the other hand, have so little pollen that extreme difficulty is experienced in securing enough with which to work. Then again, there are plants, such as many varieties of fruit trees, that will not produce seed if pollen is used on the pistils of flowers of that same plant. In some cases this is so marked as to lead us to say that pollen from the same plant used on the pistils of that plant actually poisons the whole floral structure. On the other hand, garden peas, sweet peas, and the inconspicuous green flowers of the violet normally pollinate themselves, i. e., the little pollen bags of the flowers of these plants burst open and shed their dust on the already sticky pistil before the flower has passed the bud stage. When the flower opens, a sort of an April-fool joke is played on the rest of Nature, because its little seeds are already on their way to becoming grown up. The ideal material for the study of our laws of heredity, so far as our present knowledge goes, is a plant with flowers normally self-pollinating, of fair size—flowers that will stand mutilating and bagging without undue tendency to fall, flowers which produce a large quantity of seed from a single flower, and flowers with a long blooming period. Plants easy to raise, which give two or three generations a year, are additional recommendations, as every one is impatient for results. There are many such plants, but perhaps the garden pea is one of the commonest and has most of these desirable attributes. The lily lacks a great many of these virtues, and one of the worst drawbacks to its use is the length of time (two to five years) that is required to secure a blooming plant from seed. By the time a generation grows up, one has lost interest in it. Because the garden pea was such ideal material, Mendel, the father of the science of genetics, used it for the working out of his problems. Had he used such plants as dandelions, evening-primroses and corn, I fear we would still be compelled to admit that our knowledge of heredity is a hopeless chaos, and heredity itself—"a maze in which science loses itself."

With such a plant as the pea, we start our crossing work, and the tools we need are mostly innate attributes—infinite care and patience, and, in addition, a few paper bags or cel-

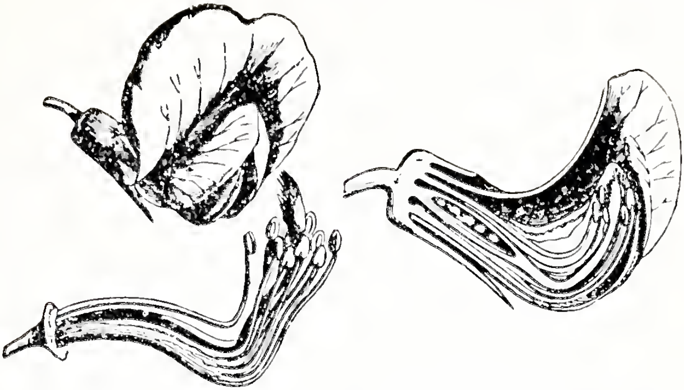

Fig. 1. Details of the garden pea flower; longitudinal section of the flower showing the four whorls; the two outer whorls removed, showing the ten stamens and the brush-tipped pistil. (After Warming.)

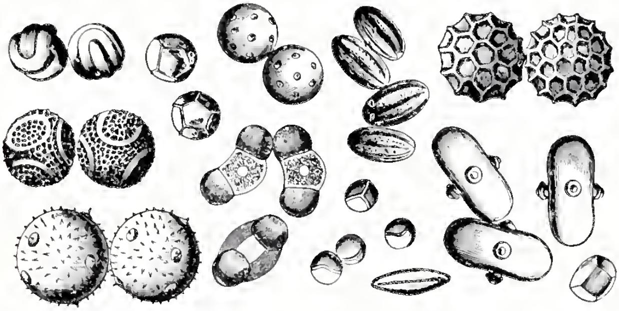

Fig. 2. Pollen grains from various common plants, many times enlarged. The plants represented are: *Mimulus*, Pink, Morning-glory, *Salvia*, *Coboea*, Passion-flower, Pine, *Morina*, Pumpkin, Hemp, *Albucca* and *Corydalis.* (After Kerner and Oliver.)

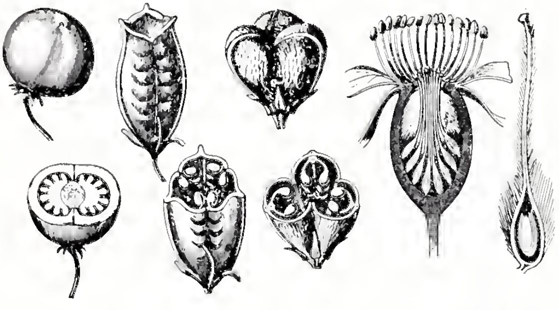

Fig. 3. Immature fruits and seed capsules of the Potato, Mignonette and Violet, with cross sections of the same showing their immature seeds. Also longitudinal section of a young rose hip, showing the structures that later become seeds. At the extreme right is a longitudinal section of a single pistil of of the rose, showing the seed forming organ at the base. All figures magnified. (After Kerner and Oliver.)

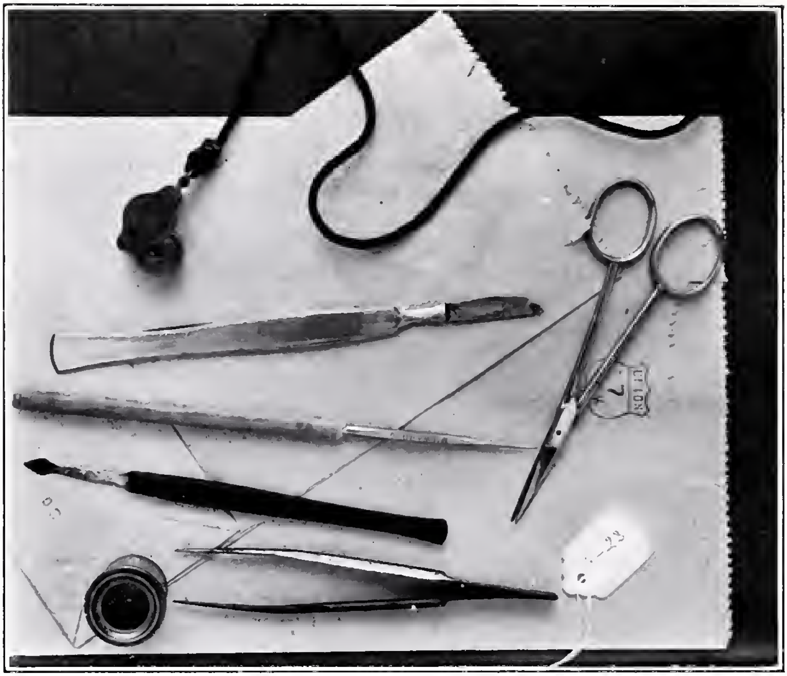

Fig. 4. Apparatus used in crossing flowers.

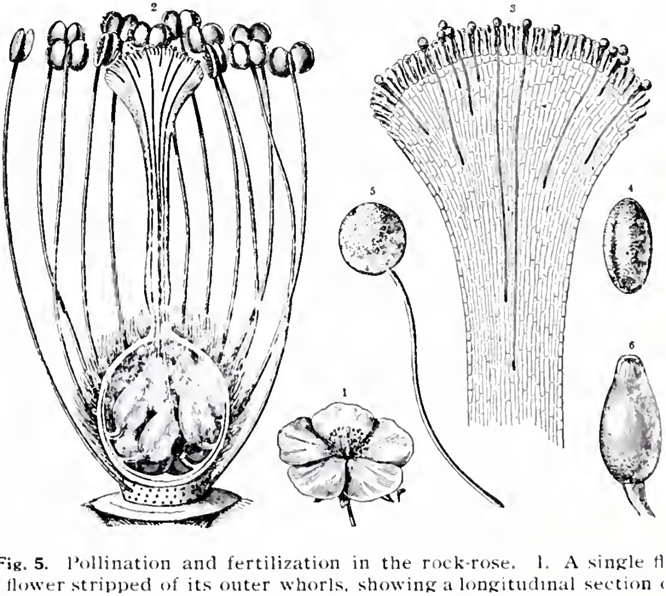

Fig. 5. Pollination and fertilization in the rock-rose. 1. A single flower. 2. A flower stripped of its outer whorls, showing a longitudinal section of the pistil and the thread-like pollen-tubes growing down into the ovules or seed-producing organs. 3. Enlarged view of upper part of pistil, showing the germinating pollen grains. 4. A single pollen grain, much enlarged. 5. A single germinated pollen grain. 6. A single ovule. All figures except (1) enlarged. (After Kerner and Oliver.)

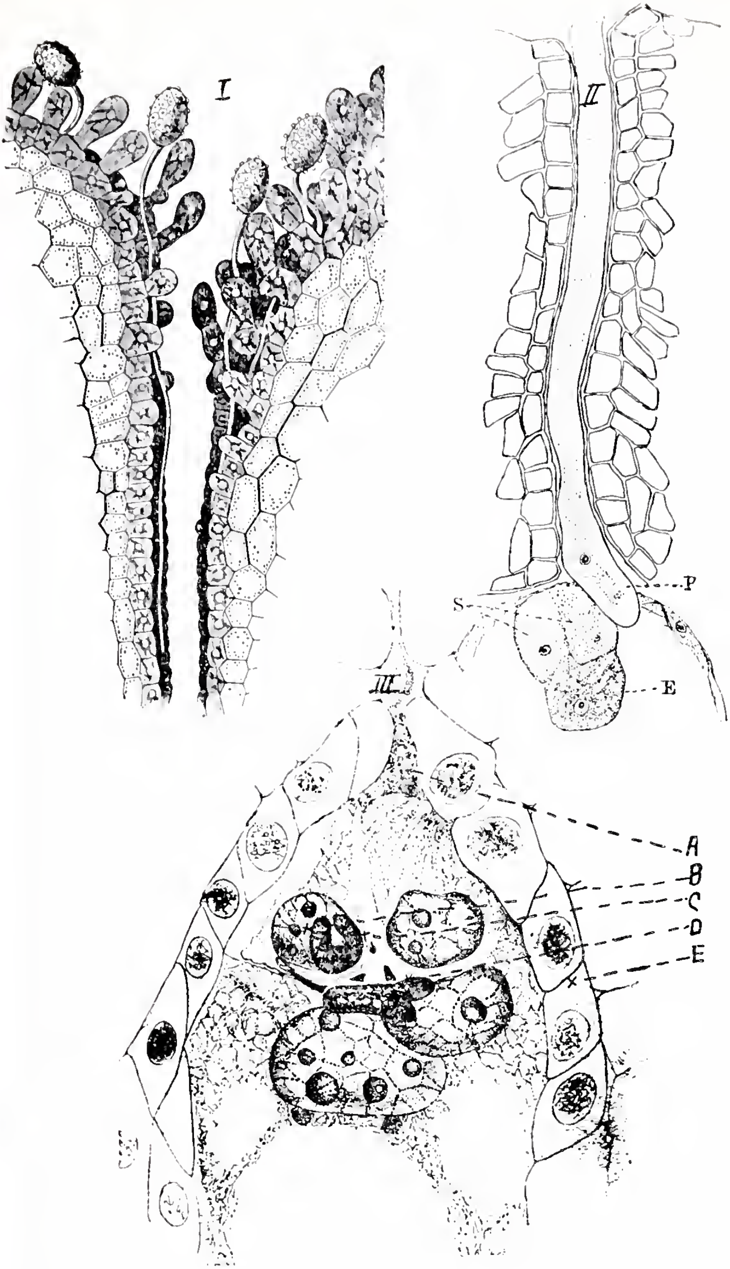

Fig. 6. The growth of the pollen-tube and the union of the maternal and the paternal cells, which are responsible for the new generation. (I) Section of a lily pistil, showing the course of the pollen tubes. (After Kerner and Oliver.) (II) Section of the pistil of a cotton flower, showing the pollen tube (P) just entering the ovule. (E) The plant egg. (After Duggar.) (III) Upper portion of a section of the ovule or egg-containing organ of the lily. Union of the sperm or male cell (c) and the egg (b) is in process of taking place. (A) is the remnant of the pollen tube, and (D) is the second sperm which unites with the two endosperm cells close to it, to form the starchy food substance of the seed. (After Blackman.)

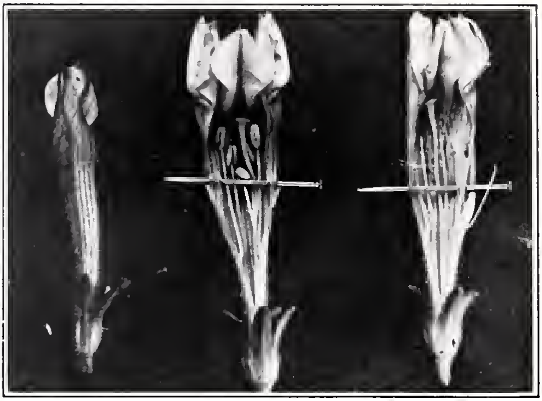

Fig. 7. Tobacco flowers, illustrating the stage at which the pollen receptacles should be removed, preliminary to crossing.

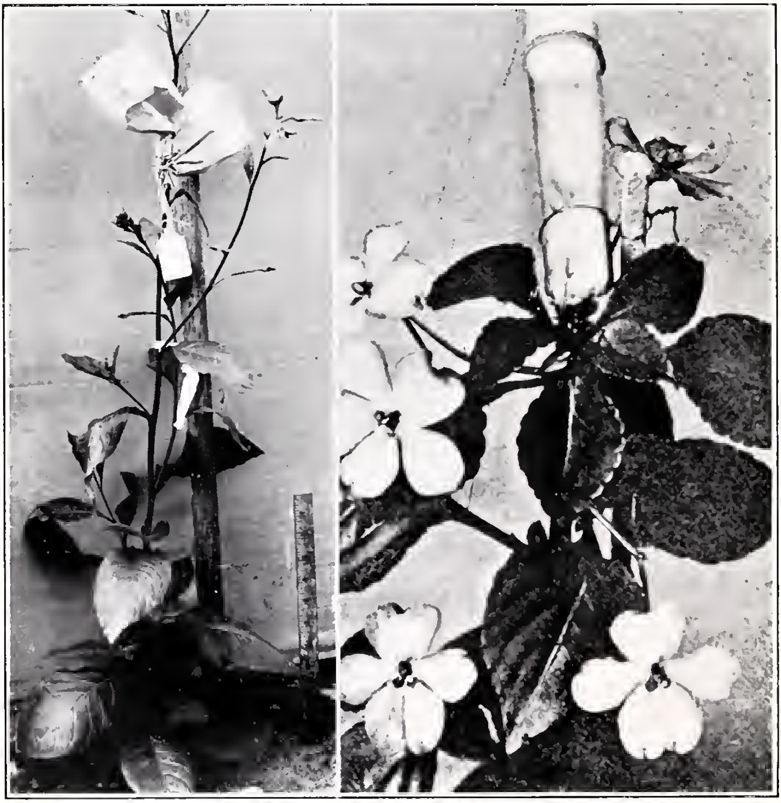

Fig. 8. Crossed flowers of tobacco and *Impatiens*, showing manner of protecting them from foreign pollen. (*Impatiens*, after East.)

luloid cylinders, a little cotton, a small, smooth one-piece blade and handle knife, a spear-head needle, spring steel tweezers, price tags, and a bottle of 50 or 60 per cent alcohol. We select a half-grown bud, carefully remove its ten stamens by inserting the tweezers between the folded petals, or by cutting away some of the petals with our knife. We first make certain that the stamens are too young to shed their pollen, after which we carefully tag the flower with date of operation, clean our instruments and hands carefully with alcohol, and cover the flower just operated upon with a small, light, tough, square-bottomed manila bag, and tie it at the base. This keeps out pollen carried by the wind or by insects. In winter time, with peas in a greenhouse, this bagging is unnecessary. In a day or two, when the pistil is ready, we take off the bag, put some pollen from the unopened pollen bag of the plant that is to be the father upon the sticky brush-like pistil, cover the latter flower again with the bag, wash the knife or brush used in applying the pollen, and await the seed—the seed that may grow into plants that look exactly like the father or the mother, or, more likely, that look like both father and mother, or that resemble neither of the parents, nor of the ancestors of these parents back even unto the tenth generation.

Now, the practical breeder would consider it a waste of time and patience to go through this tedious process described above. He must get results and get them quickly, for results bring money, and money brings inspiration and other good things. So he does not use paper bags, or alcohol, nor does he care to be absolutely certain of the father of his newly created variety. He makes his cross, sometimes not even removing the pollen bags of the flower he uses as a mother, though generally these are removed. He works rapidly, makes many crosses, and when the plants from his crosses bloom and produce flowers and fruit, he picks out the kinds that are commercially valuable and destroys the ninety and nine worthless children, often in a huge bonfire. His is a hit or miss method. Sometimes he uses pollen from four or five kinds of plants and shrewdly guesses at the one that became the father of his new plant creation, by its looks. Sometimes his guess is correct, sometimes it is far from the truth. Because of this element of uncertainty in the methods of the practical breeder of plants, we are to-day very much in the dark as to the ancestry of most of our cultivated variety of vegetables, flowers and fruits. Whether the Concord grape is a cross between a wild grape of this section of the country and a variety of old world grape—the raisin grape, or a seedling variation of the wild grape, is a disputed point, about which we can only guess. The same thing is true regarding the paternal ancestry of many other varieties of fruit and flowers. The Christmas-flowering and picotee types of sweet pea are other examples. The former is claimed by its originator to be a cross between the true sweet pea and a variety of vetch; while the first variety of the latter type won an award from the Royal Horticultural Society of England under the name of "Blue Hybrid", the belief being that it was a cross between the true sweet pea, *Lathyrus odoratus*, and the blue-flowered *Lathyrus Magellanicus*, the Lord Anson's pea of the old-fashioned gardens of our grandparents. In another LEAFLET I hope to show why it is important that we should discover all we can about the laws of heredity as soon as possible; why, in the end, that we shall find the so-called impractical scientific method to be in reality the most practical of methods.

For those of you interested in making of hybridizing plants a pastime, and having neither the patience nor desire to do scientific work, I would say, by all means cross the plants you care most about and see what you can get. I am certain there is a rich field of exploration before you, and one in which, if pursued for any length of time, you will find absorbing interest, even though you are not able to give to the gladioli the perfume of a sweet pea, or to make a rose that is a pure blue and immune to all diseases. But there is one caution I almost forgot to mention regarding the kinds of plants that may be successfully crossed. Unfortunately, or fortunately, depending on whether you are a plant breeder or a plant classifier, egg plants apparently will not cross with willows, or oak trees with sweet peas. In general, plants that are most closely "related" will cross most easily. For example, varieties of the same species are more certain to cross successfully nine times out of ten than two varieties of different species that belong to the same genus. And again, species belonging to the same genus may be expected when crossed to produce seed more often than crossings of plants of two species from separate genera, though belonging to the same family. Thus, varieties of pansy cross easily among themselves. The same is true of beans, corn and peas. Among the forty or more species of the genus *Nicotiana* (the genus of which our tobacco is a member) some species, such as the little red-flowered *N. forgetiana* and the large white-flowered *N. alata*, are easily crossed, while between other species, such as *N. plumbaginifolia* and *N. tabacum*, a successful cross has never been made, though often tried. All our varieties of petunias are said to have come from crossing the two species, *Petunia violacea* and *Petunia nyctagyniflora*. The species of the genus *Viola*, to which our pansies and violets belong, cross easily among themselves even under wild conditions, and this is true of the species of many other well-known genera, such as *Rubus* (raspberries and blackberries), *Rosa* (roses), *Salix* (willows), and *Quercus* (oaks). Successful crosses between members of different genera belonging to the same family are not as numerous as between members of the same genus, although there are a sufficient number recorded to show there is a chance of securing them among genera that have not been tried out. Crosses between orchid genera are comparatively common, this family having been the subject of very extensive commercial crossing, as practically every new form has a commercial value. Crosses between two different families are extremely rare. The only one of which I am aware is a cross between *Digitalis ambigua* (*Scrophulariaceae*) and *Sinningia speciosa* (*Gesneraceae*). In general, then, the beginner should cross plants belonging to the same genus, unless prepared to do a lot of work for very few results, though these few results might prove to be of a very startling nature.

ORLAND E. WHITE.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Avenue trolley to Malbone Street; Franklin Avenue and Lorimer Street trolleys to Washington Avenue; St. John's Place trolley to Sterling Place; Ninth Avenue, Sixteenth Avenue, Union Street, Greenpoint and Smith Street trolleys to Prospect Park Plaza and Union Street, and Brighton Beach elevated to Consumers' Park Station. (The elevated train stops only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or bi-weekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES III BROOKLYN, N. Y., OCTOBER 27, 1915. NUMBER 12

HOUSE PLANTS

It is well to recognize at the start that many difficulties have to be faced before plants can be grown successfully in an ordinary dwelling house, but, by giving careful attention to cultural details, these can, in most cases, be overcome. The hot, dry atmosphere, the fumes of illuminating gas, insufficient light, and great variation in day and night temperature, all tend to make the cultivation of house plants a difficult operation. However, in spite of these drawbacks, it is possible to grow quite a variety of plants in an ordinary house, and one need not be limited to the ubiquitous India rubber plant. It is among the so-called "foliage" plants that the greatest number of suitable subjects for the purpose under consideration are to be found. The Boston ferns in variety, dracaenas, pandanus, aspidistra, and sanseviera are all well adapted to withstand adverse conditions. In selecting flowering plants, those should be chosen, as far as possible, which make a large part of their growth out of doors. Among this class of plants are the forcing bulbs, such as hyacinths, tulips, crocus, and the well-known and indispensable azaleas. Primroses and cyclamen will also last quite a long time in good condition.

The best aspect for the majority of plants is in a window facing south or southwest, as there are comparatively few plants that will grow satisfactorily without abundance of light. If a well-lighted position is not available, one's choice is almost entirely restricted to palms and ferns. A bay window on the sunny side of a house will provide almost ideal conditions for quite a number of plants, and a delightful effect may be obtained either by growing them in pots or in boxes constructed to fit the window.

This is especially true if light is not shut out from the plants by a superabundance of window shades and curtains.

Temperature is an important factor in the successful cultivation of plants, and violent fluctuations should be avoided as far as possible. If warmth-loving plants are grown in a room which is unheated at night, as often happens, they should be protected in some way during severe weather. This may be done by removing them to a heated room or away from the vicinity of the windows. If this is impossible, they can be protected by covering them with paper or other non-conducting material. Bound up with the question of temperature is that of ventilation. Plants object to impure air as much, or more, than human beings; therefore, the room in which they are grown should be ventilated whenever possible, taking care, however, that cold drafts do not blow directly on the plants.

One is frequently asked, "How often must I water my plants?" To this one is compelled to reply, "As often as they need it." There can be no fixed rule as to the quantity and frequency of the application of water to plants; so much depends upon the humidity of the room in which the plants are growing, the nature of the plant, and the capacity of its roots to absorb water. Whenever watering is done it should be done thoroughly, taking care that the earth is wet all through. No further watering is needed until the earth shows signs of drying out, when another application should be given. Thorough watering is most important, otherwise the earth on the surface of the pot may have the appearance of being moist, while an inch or so below the surface it may be dust dry, greatly to the detriment of the plant.

Those living in a city often have difficulty in obtaining a supply of suitable soil for potting purposes, and the best plan in such cases is to obtain soil ready mixed from a florist. The best kind of soil for the majority of house plants is that formed of loam cut from the surface of a meadow or pasture. This should be mixed with stable manure in the proportion of three parts of soil to one part of manure, piled in a heap, and left for a year or so in order that the grass roots and manure may decay. Using this as a base, by the addition of leaf mould, peat, or sand, for such plants as need it, we have a soil that makes a suitable potting medium for almost any class of plants.

No definite rule can be laid down as to when plants should be repotted. If they are making vigorous root growth this may be done at almost any time, but, as a general rule, repotting is best done in early spring, just before the plants begin their new growth. Repotting into a larger pot should only be done when the pot is crowded with roots, otherwise harm rather than good will result; indeed much of the unhealthiness in house plants can be traced directly to attempting to grow them in too large a pot. It sometimes happens that repotting is necessary because there are too *few* roots in the pot rather than too many. This occurs when, through overwatering, the earth becomes sour, and, as a consequence, the roots are unable to maintain themselves in a healthy condition. Plants in this condition should have the soil gently washed from the roots, taking care not to injure them in the process, previous to repotting them in fresh, sweet soil. The new pots should be washed clean and allowed to dry before using. Proper drainage is very important in order that superfluous water may be readily carried off, and this is best obtained by placing a layer of broken pots or coarse ashes over the bottom of the pot. The plant should then be placed in position and earth filled in around it, tamping the earth down with a piece of lath or something similar, in order that it may come uniformly in firm contact with the roots. Care must be taken not to pot the plant too deeply; the old ball of earth should be covered with about one-fourth inch of soil.

Owing to lack of facilities for syringing, plants in dwelling houses rapidly become coated with a layer of dust, and this must be removed if they are to be kept in good health. Those plants having large, leathery leaves are best dealt with by washing; using a soft sponge and tepid soapy water. This process is too tedious an operation in the case of ferns and plants having small leaves, which should be washed by forcibly spraying them with water from the faucet or garden hose. Advantage should be taken of warm gentle rain by placing the plants out-of-doors, as they are greatly benefited by this process.

The insects most likely to infest house plants are aphids, mealy-bug, scale, and red spider. Aphids can easily be exterminated by spraying, or by dipping them in a nicotine solution; or an insecticide can be made by dissolving ordinary soap in water at the rate of one pound of soap to eight gallons of water. Scale and mealy-bug are more difficult to dispose of. The surest way is to wash them off with a sponge and soapy water; if this is impracticable, kerosene emulsion or one of the proprietary insecticides, used as a spray or dip, will, if persevered in, ultimately dispose of them. Red spider flourishes in a warm, dry atmosphere such as is usually found in living rooms, and if it once obtains a footing it is extremely difficult to control. Washing, as in the case of mealy-bug, is the best remedy; failing this, the under sides of the leaves should be sprayed with water with sufficient force to dislodge the insects.

All house plants are benefited by being placed out-of-doors during the warm summer months. This is especially true of azaleas, which should be placed in a partially shaded position outside as soon as danger of frost is over. All pot plants when grown out-of-doors should have their pots plunged to the rim in earth or ashes, as this helps to prevent the soil from drying out too rapidly, and also effects a saving of labor so far as watering is concerned.

Following is a list of plants that, given reasonable care, will thrive under house conditions:

Low temperature 45°–50°—(winter temperature)

FOLIAGE PLANTS

Scientific names	Common names	Remarks
*Agave americana	Century Plant	Use rather poor soil
Araucaria excelsa	Norfolk Island Pine	
Asparagus medeolioides	Smilax	Trailer
*Asparagus plumosus	Asparagus Fern	Trailer
*Aspidistra lurida	Parlor Palm	
*Begonia Rex	Rex Begonia	
*Cyperus alternifolius	Umbrella Plant	Pot should be kept partially submerged in water
Dracaena indivisa	Fountain Plant	
*Ficus repens	Creeping Fig	Trailer
Grevillea robusta	Silky Oak	
Hedera Helix	English Ivy	Trailer—good for growing in shade
*Phoenix canariensis	Canary Island Date	
*Saxifraga sarmentosa	Mother of Thousands	Trailer
*Tradescantia (several species)	Wandering Jew	Trailer

FLOWERING PLANTS

Azalea indica	Indian Azalea	Likes peaty soil
Azalea mollis	Ghent Azalea	Likes peaty soil
Camellia japonica	Camellia	Likes peaty soil
Chrysanthemum (many varieties)		Should be grown out-of-doors during summer
Cyclamen		
Daphne odora	Sweet Scented Daphne	
*Epiphyllum truncatum	Christmas Cactus	Use rather poor soil
*Pelargonium domesticum	Lady Washington Geranium	
*Pelargonium zonale	Zonal Geranium	
*Phyllocactus vars.		
Primula sinensis	Chinese Primrose	
*Richardia africana	Calla Lily	Needs rich soil and abundance of water
Viburnum Tinus	Laurestinus	
*Bulbs in great variety		

High temperature 60°–70°—(winter temperature)

FOLIAGE PLANTS

Scientific names	Common names	Remarks
Areca lutescens	Yellowish Areca	Palms All delight in well drained rich soil and abundant moisture
Cocos Weddelliana	Weddell's Cocos	
Kentia Belmoreana	Curly Palm	
Kentia Fosteriana	Thatch-Leaf Palm	
Latania borbonica	Fan Palm	
Phoenix Roebelini	Pigmy Phoenix	
Cycas revoluta	Sago Palm	
Dracaena Godseffiana	Gold-dust Dracaena	
*Dracaena Massangeana		
Dracaena Sanderiana		
Dracaena terminalis		
*Ficus elastica	India Rubber Plant	
*Ficus pandurata	Majestic Rubber Plant	
Ficus religiosa	Peepul	
*Nephrolepis exaltata bostoniensis and many varieties	Boston Ferns	
*Pandanus utilis	Screw Pine	
Pandanus Veitchii	Screw Pine	

FLOWERING PLANTS

Scientific names	Common names	Remarks
*Begonia argenteo-guttata		Begonias grow best in a compost containing a good proportion of leaf soil
*Begonia manicata		
*Begonia semperflorens	Ever-flowering Begonia	
Begonia Thurstoni	Thurston's Begonia	
Impatiens Sultani	Zanzibar Balsam	

Plants marked * will grow in either cool or warm temperature. Except where otherwise specified, loam, with a small proportion of decayed manure, should be used as potting soil.

M. FREE.

N. B.—This Leaflet is the last one of Series III.
Number 1, Series IV, will appear in April, 1916.

PLANTS NOW IN FRUIT IN THE ECONOMIC HOUSE

Entering the Economic House from House No. 4, one sees opposite the doorway a fruiting specimen of the papaya, or pawpaw, *Carica Papaya.* The fruit is edible, and from it is obtained the papain of commerce, used in medicine. In the tropics fresh meat is made more tender by being cooked, wrapped in the leaves of this plant. Turning to the right, one may observe in succession the following plants that have set fruits: The fig, *Ficus Carica*, a species cultivated from remote antiquity. The tangelo, an interesting hybrid between the tangerine and grape-fruit. Other citrus plants that have set fruit are the grape-fruit, lemon, kumquat and lime. Trained upon one of the supporting columns is an interesting plant, extensively cultivated in India, the white gourd melon, or wax gourd, *Benincasa cerifera.* A waxy substance is secreted on the surface of the fruit which is said to be collected and made into candles. The fruit is used extensively in India for medicinal purposes, and is also used as a vegetable and for making a sweetmeat called *heshim*.

A beautiful specimen of the palm, *Cocothrinax crenata*, rare in cultivation, has been recently placed on exhibition in this house by Mr. John Lewis Childs, of Floral Park, L. I.

LIST OF LEAFLETS

SERIES I, 1913

1. Foreword. Some plants flowering early in April.
2. The opening of buds.
3. Kinds and position of buds.
   Some native wild flowers now in bloom.
4. Some plants flowering early in May.
5. The pollination of pines.
   Plants now in bloom.
6. Plants flowering in the last half of May.
7. The leaves of pines and other conifers.
8. The work of green leaves.
   Plants now blooming.
9. Respiration in plants.
   Shrubs now in bloom.
10. Some interesting varieties of corn growing in the Garden.
11. Our native shrubs and what may be done with them.
12. Bulb culture.
13. Kinds and characteristics of bulbs.
14. Leaf fall.

SERIES II, 1914

1. Backyard gardens.
2. The wild flower garden.
3. Tree planting.
4. Ornamental climbers.
5. Information for teachers about the Brooklyn Botanic Garden. Plants now in bloom.
6. Children's Garden Exhibit.
7. Vandalism turned to account.
8. Heredity, variation and environment.
9. Hedge plants.
10. Window boxes.
11. The potato industry of northern Maine and its relation to that of Long Island.
12. The history of Nicotiana II: An account of the heredity and environment of a family of tobacco plants.

13 & 14. Grafts, grafting and graft-hybrids.

SERIES III, 1915

1. List of talks for elementary school classes.
2. The second annual children's garden exhibit.
3. Plants for hanging baskets.
4. The nature of plant diseases.
5. A walk through the Garden.
6. The origin and history of some of our more common garden vegetables.
7. The children's Garden Exhibit.
8. The Boston fern and some of its varieties. Exhibit of ferns.
9. Talks for elementary school classes.

10 & 11. The crossing of flowers.

12. House plants.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Avenue trolley to Malbone Street; Franklin Avenue and Lorimer Street trolleys to Washington Avenue; St. John's Place trolley to Sterling Place; Ninth Avenue, Sixteenth Avenue, Union Street, Greenpoint and Smith Street trolleys to Prospect Park Plaza and Union Street, and Brighton Beach elevated to Consumers' Park Station. (The elevated train stops only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

The LEAFLETS are published weekly or bi-weekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

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